GAIL (India) Limited

(A Govt. of India Undertaking)
A Navratna Company
NEW DELHI, INDIA

KOCHI-KOTTANAD-BANGALORE-MANGALORE NATURAL GAS PIPELINE PROJECT (PHASE-II)

BID DOCUMENT FOR PROCUREMENT OF

RTU FOR CENTRALISED SCADA SYSTEM

UNDER OPEN INTERNATIONAL COMPETITIVE BIDDING

E-Tender no. 8000004252

BID DOC. NO. : 05/51/23 ME/GAIL /094

VOLUME–II OF II
PREPARED AND ISSUED BY

MECON LIMITED
(A Govt. of India Undertaking)
Delhi, India

MAY , 2012

INDEX

VOLUME–II OF II

RTU FOR CENTRALISED SCADA SYSTEM FOR KKBMPL (PHASE-II) PROJECT

BID DOC. NO.: 05/51/23 ME /GAIL/094

A. MATERIAL REQUISITIONS

B. BIDDER QUALIFICATION CRITERIA (BQC) FORM

C. VENDOR DATA REQUIREMENT

D. VENDOR DRAWING/ DATA APPROVAL PROCEDURE

E. VENDOR DRAWING/ DOCUMENT SUBMISSION SCHEDULE

F. PARTICULAR JOB SPECIFICATION FOR RTU FOR CENTRALISED SCADA SYSTEM.

(JS No.: MEC / 23ME/ 05/ E5/ I/ PJS-094 (RTU))

0	31.05.2012	ISSUED FOR BID	Harsha	Rakesh	Pankaj
Revision	**Date**	**Description**	**Prepared by**	**Checked by**	**Approved by**

GAIL (INDIA) LIMITED

New Delhi

KOCHI-KOTTANAD-BANGALORE-MANGALORE NATURAL GAS PIPELINE PROJECT (PHASE-II)

MATERIAL REQUISITION
RTU FOR
CENTRALISED SCADA SYSTEM

MR NO.: MEC/S/05/E5/T/23ME/GAIL/094 (RTU)

Bid Document No. : 05/51/23ME/GAIL/094 (RTU)

Prepared & Issued by

ELECTRICAL &
INSTRUMENTATION SECTION
MECON LIMITED
DELHI - 110 092

MATERIAL REQUISITION

ITEM : RTU FOR CENTRALISED SCADA SYSTEM
PROJECT : KOCHI-KOTTANAD-BANGALORE-MANGALORE NATURAL GAS PIPELINE (PHASE-II)
MR NO : MEC/S / 05/ E5/ T/ 23 ME / GAIL / 094 (RTU)
BID Doc NO : 05/51/ 23 ME / GAIL / 094 (RTU)
CLIENT : GAIL (India) LIMITED

Sr. No.	D E S C R I P T I O N	Unit	Quantity
	Project Management, Design, Engineering, Procurement of Materials, fabrications/ manufacturing, Inspection & Factory Acceptance Testing at works, Supply, Packaging, Shipping, Insurance, Port Handling, Custom Clearance, Inland Transportation to site, Storage & Safety, Installation along with necessary software, installation material, cables, connectors, RTU panels, erection of foundation support channel on trench for panel erection, cable trays, test instruments /equipments, Site Acceptance testing & Integration with Centralised SCADA system, Test Run, Pre-commissioning activity, Commissioning, Integration Telecom System & local IEDs, Training, Warranty, Extended Warranty, Mandatory & commissioning spares, Documentation etc and shall be executed on turnkey indivisible works contract basis as per details scope of work, Technical Specification of RTU - Annexure I to PJS, & Job specification PJS No. MEC / 23ME / 05 / E5 / I / PJS-094 (RTU) Rev 0 provided in the tender documents.		
A	**Supply**		
	Supply & all the work define above of Remote terminal units (RTU) with accessories as per the Technical Specification of RTU - Annexure I to PJS, & Job specification PJS No. MEC / 23ME / 05 / E5 / I / PJS-094 (RTU) Rev 0.		
A.1	For Sectionalising Valve (SV) Stations. Bidder shall provide the price Break-up for supply as per the enclosed format - 1 along with offer	Nos.	43
A.2	For Receiving Stations / Despatch stations Bidder shall provide the price Break-up for supply as per the enclosed format - 1 along with offer	Nos.	03
A.3	For Intermediate Pigging (IP) Station Bidder shall provide the price Break-up for supply as per the enclosed format - 1 along with offer	Nos.	07
A.4	Mandatory Spares :		
a.	Supply of loose Mandatory Spares (10% of all type of Installed cards, convertors, power supply/converters, termination boards, OEM cables between cards and termination boards, backplanes, relays etc accounted & calculated considering for total quantities of RTU (53nos) during calculation of mandatory spares as defines in Job specification PJS No. MEC / 23ME / 05 / E5 / I / PJS-094 (RTU) Rev 0. Clause no 6.47 (a)). **(Bill of Material has to be provided along with offer, any fraction quantity should be round off to nearest number in higher side).** **Unit rate for Mandatory spares with cards details, part no., make etc. shall be given separately with the offer & price part.**	Lump -sum	01
b.	GSM modem with antenna & accessories	Nos.	02
c.	Industrial standard Tool kit for equipments with leather bag:	Nos.	04
d.	Spare fully wired RTU similar to SV Stations I/O configuration type with necessary accessories as required.	Nos.	04
e.	Spare fully wired RTU similar to Receiving Stations I/O configuration type with necessary accessories as required.	Nos.	04

A.5	PDT with all accessories including all cables & connectors as per the Technical specifications of RTU (one each for Bangalore & Mangalore)	Nos.	02
A.6	Test equipments as per specification		
a.	Portable Power Source cum Calibrator (Current & Voltage) as per specification (one each for Bangalore & Mangalore)	Nos.	02
b.	4 ½ Digit Multi-meter as per specification (Bangalore & Mangalore)	Nos.	02
c.	Protocol Analyser as per the specification defines in the Job specification PJS No. MEC / 23ME / 05 / E5 / I / PJS-094 (RTU) Rev 0. (Bangalore & Noida)	Nos	02
d.	RTU test unit (test jig) with each type of RTU cards, power supply, CPU, communication, serial, AI,DI,AO,DO cards for simulating RTU test environment (to be mounted in 19" rack) (Bangalore & Noida)	Nos.	02
e.	RTU configurator software	No.	01
A.7	Extended post Warranty **per month** from the date of actual expiry of main warranty (i.e. period of 24 months (two years) from the date of "provisional" acceptance of the system by the owner or 28 months from the actual delivery of material at site after FAT and issue of IC which ever is earlier) as per the terms & condition of contract and as define in clause no. 24.0 of PJS).(Refer Note 7)	Months	24
B	**SERVICE AND SITE WORK** Installation, Testing & commissioning, Interfacing with Instrumentation, Telecommunication, Electrical, CP system, any other work for the completion/ hook-up of RTU to Centralised SCADA system complete in all respect.		
B.1	For Sectionalising Valve (SV) Stations. Bidder shall provide the price Break-up for services & site work as per the enclosed format - 1 along with offer	Nos.	43
B.2	For Receiving Stations / Despatch stations Bidder shall provide the price Break-up for services & site work as per the enclosed format - 1 along with offer	Nos.	03
B.3	For Intermediate Pigging (IP) Station Bidder shall provide the price Break-up for services & site work as per the enclosed format - 1 along with offer	Nos.	07
B.4	Training (as define in specifications) before the final acceptance of the SCADA system by the Client.	Lump-sum	1
C	All inclusive **per month rates** for maintaining the store at site (for the supplied material) during the extended period as required (payable if site is not ready even after 6 months of actual date of completion (i.e. 22 months from FOI) as per terms & condition of contracts and as define in the tender scope of work).(Refer Note 8)	Months	12

NOTES:

1. Bidder shall quote for all the items.
2. Bid offer will be evaluated package wise. All the items of part A & B will be considered for evaluation purpose. Completion of total work as a TURNKEY work is Bidder's responsibility.
3. Detail list of the commissioning spares shall be furnished along with the offer.
4. Details of Mandatory spares with part no., make etc. shall be given separately with the offer & price part.
5. The quantity and the location of the stations may change; bidder shall take prior approval for procurement and erection.
6. Bidder shall submit the price break-up of (sub-items/ activities/ parts) inclusive in the quoted Unit rate for RTU specified above in enclosed format - I along with offer & price part. It shall be used for any addition or deletion of sub items if required.
7. Bidder shall quote extended post Warranty **per month** from the date of actual expiry of main warranty (i.e. period of 24 months (two years) from the date of "provisional" acceptance of the system by the owner or 28 months from the actual delivery of material at site after FAT and issue of IC which ever is earlier) as per

the terms & condition of contracts. Period for extension will be finalised by the client as per the requirements and accordingly payments will be made as per SOR rate. Refer Clause no. 24.0 of Particular Job specification of the tender.

8. Bidder has to complete the work as per the schedule, if the site is not ready even after 6 months of the completion schedule as define in the contract then bidder may compensate the expenditure of store (as per all inclusive rate per month available in the tender) till the readiness of the site. The payment will be made from seventh month (No payment upto six months from date of completion) onward from actual date of completion as per the certifications by EIC/ Client. In this situation, after intimation from GAIL, the site work has to be completed within the time stipulated for site works as per tender.

FORMAT - 1

Price Break- RTU for Centralised SCADA system

GAIL: KKBMPL Phase – II

SOR Item No.	D E S C R I P T I O N	Unit	SV type RTU			IP type RTU			Receiving (RT) type RTU		
		Unit	Qty	Unit Rate	Total	Qty	Unit Rate	Total	Qty	Unit Rate	Total
1	2	3	4	5	6	7	8	9	10	11	12
	Supply of Hardware										
1.	RTU cabinet consisting of Size : 2100 x 800 x 800 plus 100 mm base channel with front door 2 nos. of tube lights (front) with door switch. 2 nos. of fans Earthing bus bar for signal / instrumentation earth Earthing bus bar for panel earth *(copper thickness 25 x 4 mm)* Drawing pocket (front) DIN Rails Cable Ducts Glanding plates	Lot	01			01			01		
2.	Terminal Blocks in RTU Cabinet Panel (Two termination for each signal input.) consisting of										
a	Terminal Blocks for DI (16 Inputs)	Nos.	01			01			02		
b	Terminal Blocks for DO (8 Outputs)	Nos.	01			01			01		
c	Terminal Blocks for AI (8 Inputs)	Nos.	03			03			04		
d	Terminal Blocks for AO (4 Outputs)	Nos.	00			01			01		
3.	Internal wiring between terminal blocks and IO Module in RTU Chasis										
a	Entire DI module (min 16 inputs)	Nos.	01			01			02		
b	Entire DO module (min 8 Outputs including wiring for external relays)	Nos.	01			01			01		
c	Entire AI module (min 8 Inputs)	Nos.	03			03			04		
d	Entire AO module (min 4 Outputs)	Nos.	00			01			01		
4	RTU Rack / Chassis (s) / Back Plane with necessary mounted units required as a minimum										
a	RTU Rack / Chassis / Back plane having minimum 10 slots with mounting arrangements	Nos.	01			01			01		

FORMAT - 1
Price Break- RTU for Centralised SCADA system
GAIL: KKBMPL Phase – II

b	RTU Rack / Chassis / Back Plane Power Supply Unit	Nos.	01			01			01		
c	CPU card (32-bit with 64 MB Flash)	Nos.	01			01			01		
d	Shall include following communications ports as a minimum (to be indicated if not included in CPU Card):										
e	For polling from MS/ BMS: 1.) Ethernet : 2 nos. 2.) RS 232: 2 nos.	Lot	01			01			01		
f	For diagnostics: 1 nos. for connecting PDU for diagnostic and local configuration of RTU either on Ethernet or Serial	Nos.	01			01			01		
5	Input / Output Modules										
a	48V to 24V DC Converter along with Surge Arrester along with terminal blocks for power cable termination and MCBs	Nos.	00			00			00		
b	24V to 24V DC Converter along with Surge Arrester along with terminal blocks for power cable termination and MCBs	Nos.	01			01			01		
c	230V AC to 24V DC Converter along with Surge Arrester along with terminal blocks for power cable termination and MCBs	Nos.	00			00			00		
d	DI Card(s) (16 Inputs)	Nos.	01			01			02		
e	DO Card(s) (8 output including external relays)	Nos.	01			01			01		
f	AI Card(s) (8 Inputs)	Nos.	03			03			04		
g	AO Card(s) (4 Outputs)	Nos.	00			01			01		
h	Module / Card for 2 nos of RS 232 / RS485 (software - selectable) Serial ports for IED interface:	Nos.	02			02			04		
6	Extension Rack/ Module for mounting in the same RTU Panel / Cabinet (if applicable)	Nos.	00			00			02		
a	Extension Rack / Chassis / Back plane having minimum 10 slots with mounting arrangements along with power supply unit, CPU / IO Scanner module	Lot	00			00			02		
7	RTU Configuration for IO Points, Serial communication with IEDs and testing of signals from SCADA System to Tag blocks in the RTU and IEDs.	Lot	01			01			06		

FORMAT - 1
Price Break- RTU for Centralised SCADA system
GAIL: KKBMPL Phase – II

8	**Packing**										
a	Packing of RTU Panel including RTU Accessories	Lot	01			01			01		
9	**Supply of Software:**										
a	RTU Configuration / Diagnostic Software	Nos.	01			01			01		
b	Configuration Software along with software license (for 5 users)	Nos.	01			01			01		
c	Hardware Dongle (in case software license key is not available)	Nos.	00			00			00		
10	All design, detailed engineering and approval of documents, Inspection and submission of final documentations.	Lot	01			01			01		
11	**Transportation,** Loading & Unloading, Insurance of RTU Panel, IO Modules, cables and accessories from Vendor's factory in India to Vendor main site office/godown.(By reputed transporter approved by GAIL)	Lot.	01			01			01		
	Total for the Supply of one quantity as per SOR item (Must be same as unit rate of RTU – supply indicated in main SOR against sub items of "A")	**SOR A.1 (Sum of Column 6)**				**SOR A.2 (Sum of Column 9)**			**SOR A.3 (Sum of Column 12)**		
	Site services for stations	**Unit**	**SV type RTU**			**IP type RTU**			**Receiving (RT) type RTU**		
		Unit	**Qty**	**Unit Rate**	**Total**	**Unit**	**Qty**	**Unit Rate**	**Total**	**Unit**	**Qty**
12	Transportation, Loading & Unloading, Insurance of RTU Panel, IO Modules, cables & accessories from main site office / godown to individual RTU sites of KKBMPL-Ph-2.	Lot	01			01			01		
13	Erection : Erection of RTU Panel	Nos.	01			01			01		
14	Erection accessories (supply & laying of Cables, Trays, conduits etc.)										
a	Power cable (per meter)	Per Mtr	25			25			25		
b	Earthing cable (per meter)	Per Mtr	25			25			25		
c	Ethernet Cable (per meter)	Per Mtr	25			25			25		
d	Serial Cable (per meter)	Per Mtr	40			40			80		

FORMAT - 1
Price Break- RTU for Centralised SCADA system
GAIL: KKBMPL Phase – II

e	36 core / 18 pair, 0.5 sqmm , armoured DI / DO signal cables (per meter)	Per Mtr	25			25			50		
f	12 core / 24 pair, 0.5 sqmm , shielded & armoured AI / AO signal cables (per meter)	Per Mtr	25			25			75		
g	Cable trays (per meter)	Per Mtr	00			00			05		
h	Conduits (per meter)	Per Mtr	01			01			01		
i	Laying of individual signal (DI/DO/AI/AO) cables from TIC to RTU, glanding, ferruling, lugging and termination at both ends.	Per Mtr	25			25			100		
j	Laying of power cable from PDB to RTU cabinet, glanding, ferruling, lugging and termination at both ends.	Per Mtr	25			25			25		
k	Laying of earthing cable for signal earth and panel earth from earth pit / bus bar to RTU cabinet, glanding, ferruling, lugging and termination at both ends.	Per Mtr	25			25			25		
l	Laying of cable tray	Per Mtr	00			00			05		
m	Laying of Cable conduit	Per Mtr	01			01			01		
n	Laying of serial cables between RTU Serial port and IED	Per Mtr	40			40			80		
o	Laying of Ethernet cable between RTU and Telecom rack	Per Mtr	25			25			25		
p	Laying of individual signal (DI/DO/AI/AO) cables from other panel to RTU, glanding, ferruling, lugging and termination at both ends.	Per Mtr	25			25			25		
15	Online testing of field IO signal from SCADA System	Lot	01			01			01		
16	Integration, Trial Run, commissioning	Lot	01			01			01		
17	Mis Items not covered above (mention details)	Nos	01			01			01		
18	Documentation :As built (all documents & drawings as per spec 6 sets)	Lot	01			01			01		
	Total for the Services & Site work as per SOR item (Must be same as unit rate of RTU – services & site work indicated in main SOR against sub items of "B")	**SOR B.1 (Sum of Column 6)**				**SOR B.2 (Sum of Column 9)**			**SOR B.3 Sum of Column 12)**		

Note :

1. The above erection quantities indicated at sl no 14 is tentative and for estimation purpose, bidder has to provide the erection material as per the actual site requirements.

BIDDER QUALIFICATION CRITERIA (BQC) FORM
KKBMPL (PHASE-II) Project of GAIL

Bidder (quoted under clause 4.1.1 criteria of NIT)

A)	**Details of Bidder** 1. Name and address of Bidder Tel No, Fax No, E mail No. and website address, Works location and address 2. Bidder has proven facilities for design, engineering, integration, testing as per cl. 4.1.1 [yes/no] 3. Area of operation of Bidder 3.1 Vendor of RTU (Yes/No) 3.2 Own RTU offered (Yes/No) 3.3 If not OEM of RTU then OEM name with Address : 4. Letter from OEM for support for supplied RTU (if not OEM) (Yes/ No)	**Column to be filled by bidder**
B)	Details of SCADA / supply of RTU for SCADA projects as executed by the Bidder to ascertain fulfillment of tender conditions	

BIDDER QUALIFICATION CRITERIA (BQC) FORM PART – I (details for clause no. 4.1.1)		**Column to be filled for the implemented projects**
S.N	**Details**	**Project**
1.0	Project Name & Description	
1.1	Details of the application	
1.2	Details of pipe line & services	
1.3	No. of RTUs	
1.3.1	Name of RTU owner	
1.3.2	Make & model no of RTU	
1.4	Name & address of owner's contact person	
2.0	Telephone, FAX No, Email No. of owner's contact person	
2.1	a) Any system breakdowns b) Cause and duration of breakdown	
2.2	For above referred projects, the bidder as OEM has requisite experience in his own name(from same work location & address) and not in the name of its parent company located elsewhere (Yes/No)	
2.3	Weather the work executed in single (In same pipeline) order	
3.0	Whether the RTU supplied had been successfully commissioned within last seven year from the bid due date (Completion certificate / satisfactory working certificate from end user) [yes/no]	
4.0	Scope of responsibility of the Bidder	
5.0	Project Management [yes/no]	
5.1	Design & Engineering [yes/no]	
5.2	Supply [yes/no]	

BIDDER QUALIFICATION CRITERIA (BQC) FORM PART – I		Column to be filled for the implemented projects
S.N	**Details**	**Project**
6.0	Installed [yes/no]	
6.1	Testing [yes/no]	
6.2	Integration [yes/no]	
6.3	SAT & Test run [yes/no]	
6.4	Commissioned [yes/no]	
6.5	Make/ Model No of RTUs proposed for this line	
6.6	a) Documents for fulfilling BEC furnished [yes/no]	
	b) Reference List of similar job execution of SCADA/ supply of RTU with atleast the details of Purchase Order, Client name, Completion status etc furnished. [yes/no]	
	c) Client's letter for successfully completion with cross reference of PO (furnished)	
6.7	Weather the Supplied RTU integrated with a single SCADA system.	
6.8	Whether the supplied RTU can integrated with any IP based SCADA system	
6.9	Whether RTU offered for KKBMPL-PH-II project is similar or higher in specification of this tender for implemented project. [Yes/No]	
6.10	Bidder has to provide commitment letter from OEM to extend complete technical support for the proposed make of RTU during the project tenure and warranty period if the bidders is not a manufacturer.(Documents provided Yes/No)	
6.12	Bidder has to provide commitment letter from OEM to provide support for the SPARES for proposed make of RTU for as define in specification.(Documents provided Yes/No)	
C	Bidder's Office / Service center / Service associates to take care of post sales services, warranty and post warranty support: (Yes /No)	
1.1	Name & address of Office / Service Center / Service associate:	
1.2	Name of contact person	
1.3	Telephone, FAX No, Email No. of Contact person	
1.4	Having adequate trained manpower in India (Yes /No)	
1.5	Documents for fulfilling all the above furnished [yes/no]	

Bidder
Signature of the authorized signatory
Name of the authorized signatory
Stamp and Date

VENDOR DATA REQUIREMENTS

The table hereunder specifies the quantities and the nature of the documents to be submitted by the Vendor to the Client / Consultant for Approval / Record.

Any document, even when preliminary, shall be binding and therefore duly identified and signed by the Vendor. It shall bear the Project reference, the PO no. and the document identification number.

THE DOCUMENTS ARE FULLY PART OF THE SUPPLY WHICH SHALL BE COMPLETE ONLY IF AND WHEN THE DOCUMENTS COMPLYING FULLY WITH THE MATERIAL REQUISITION REQUIREMENTS ARE RECEIVED BY THE CLIENT / CONSULTANT.

Sl. No.	Documents and Data	Quotes	Certified information required after Purchase Order			
			Soft Copy	Printed Matter	Date needed	Date Promised
1	Functional design Specification for RTU	1	4	4	12 weeks	-
2	I/O Assignment	-	4	4	12 weeks	-
3	RTU Cabinet Wiring diagram	-	4	4	16 weeks	-
4	SST, SOS & PCUR From (attached with the tender) duly filled and signed by the bidder	1	-	-	-	-
5	Bill of Material	1	4	4	12 weeks	-
6	List of Mandatory Spares	1	4	4	12 weeks	-
7	List of Commissioning Spares	1	4	4	12 weeks	-
8	Suggestive Control Room Layout for each station	-	4	4	12 weeks	-
9	Equipment Interconnection diagram including details of various interfaces, signal protocols etc.	-	4	4	16 weeks	-
10	RTU Specification, internal Layout including mounting arrangement, interconnection	1	4	4	12 weeks	-
11	Internal layout of SCADA cabinets, consoles, desks etc. including mounting arrangement, interconnection etc.	-	-	-	-	-
12	LAN interconnection diagram	-	-	-	-	-
13	I/O point database	-	4	4	12 weeks	-
14	HMI Graphics (Colour document)	-	-	-	-	-
15	Standard SCADA Manual for operation & maintenance	-	-	-	-	-
16	User guides, maintenance & configuration manuals for all supplied equipments / Test instruments/ Spares/ subsystems.	-	4	4	-	W/S
17	Complier manuals including user guide, language reference, library reference etc.	-	4	4	-	W/S

18	API manuals including user guide, library reference manuals etc.	-	4	4	-	W/S
19	RTU Specification, operation, maintenance and configuration manual	-	4	4	-	W/S
20	RTU-IED interface manuals including manuals of special tools used for interfacing IEDs	-	4	4	-	W/S
21	Oracle interface manuals	-	-	-	-	-
22	Quality Assurance Plan	1	4	4	12 weeks	-
23	FAT Procedure	-	4	4	40 weeks	-
24	SAT Procedure	-	4	4	48 weeks	-
25	Test Run Procedure	-	4	4	48 weeks	-
26	IP address & protocol structure at each station	-	4	4	12 weeks	-
27	Datasheet of HMI Monitors, Laser jet printers, Color jet monitors, one routers etc	-	-	-	-	-
28	Station wise power consumption calculations of RTU	-	4	4	12 weeks	-
29	List of special Tools & Tackles	-	-	-	-	-
30	Project execution schedule	-	4	4	6 weeks	-
31	AS BUILT IO DETAILS AS PER GAIL's FORMAT	-	4	4	48 weeks	-
32	Centralised SCADA Interfacing	-	4	4	48 weeks	-
33	RTU Compatibility Test Certificate	1	-	-	-	-

Notes:

1. Fold all drawing to 210mm x 297mm.
2. Vendor to provide all printed matter and the soft copy to MECON LIMITED.
3. Legends:
   A/C= As completed, W/S= With Shipment, W= Weeks
4. Final technical document file shall be supplied in hard copy as indicated and in electronic format (.pdf Acrobat files) on two (2 Nos.) CD-ROM.
5. All these documents shall be submitted along with dispatch of the system to site.
6. FAT procedure documents must include clause wise reference of tender specification for its compliance. This document shall be prepared in consultation with owner / owner's representative.
7. The documents / information required with offer sheets to be furnished otherwise the offer shall be liable for rejection.
8. During detail engineering stage, 3 sets of printed matter and 2 soft copy shall be submitted till the final approval of documents/drawings. After approval 4 sets has to submitted.
9. As Built documents : 6 sets Printed Matter, 6 sets Soft Copy.

VENDOR DRAWING/ DATA APPROVAL PROCEDURE

RTU FOR CENTRALISED SCADA SYSTEM OF KKBMPL(PHASE-II) PROJECT
BID DOC. NO.: 05/51/23 ME/GAIL/094 (RTU)

1. Vendor must take care of the following while submitting drawings and documents for review as indicated in Vendor Data Requirements enclosed.

   A blank space measuring 75mm W x 40mm H shall be provided on all vendor drawings for marking review codes etc. by MECON LIMITED.

   The review of vendor drawings shall be done as applicable under the following review codes :

   a) Review Code Approved : Approved

   b) Review Code Approved As Noted: Proceed with manufacture/ fabrication as per commented drawings. Revised drawing required.

   c) Review Code Not Approved: Document does not conform to basic requirements as marked. Resubmit it for review.

2. Review of the vendor drawings by MECON would be only to check compatibility with basic design and concepts and would in no way absolve the manufacturer/ fabricator of his responsibility to meet applicable codes, specification and statutory rules/ regulations.

3. For drawings/ documents indicated as FOR INFORMATION in the Vendor Data Requirement, Vendor must mark FOR INFORMATION ONLY on the submitted drawings/ documents.

MECON Limited

Vendor Drawing/ Document Submission Schedule

Client/ Project : GAIL / Kochi – Koottanad – Bangalore – Mangalore (Phase-II)	Vendor's Name :	Contact Person (Name/ Tel/ Fax/ email) :	Status Date:
Item Description : RTU	PR No.:	Review Status Code:	
	Date of LOI:	1. APPROVED - No Comments	
Doc No. MEC-S-05-E5-23ME- 94-F01, Rev 0	PO No.: Date of PO:	2. APPROVED AS NOTED - Proceed with manufacture/ fabrication as per commented document. Revised document required.	
Department :	Contact Person:	3. NOT APPROVED Document does not conform to basic requirements as marked. Resubmit for Review. R: Retained for Reference V: Void	

S. No.	Drawings / Documents as per MECON Vendor Data Requirement	Vendor Drg/ Doc No. / Title	Category Review(R)/ Records(I)	Schedule Date of 1st Submission (Rev. 0)	Anticipated (Ant) / Actual (Act) / Date of Return (Rew) by MECON / Review Status (Code)	Rev. 0	Rev. 1	Rev. 2		Form Electronic (E)/ Print (P)	Remarks
					Ant						
					Act						
					Rew						
					Code						
					Ant						
					Act						
					Rew						
					Code						
					Ant						
					Act						
					Rew						
					Code						
					Ant						
					Act						
					Rew						
					Code						
					Ant						
					Act						
					Rew						
					Code						

(A Govt. of India Undertaking)
A Navratna Company
NEW DELHI, INDIA

KOCHI-KOTTANAD-BANGALORE-MANGALORE NATURAL GAS PIPELINE PROJECT (PHASE-II)

PARTICULAR
JOB SPECIFICATION

RTU FOR CENTRALISED SCADA SYSTEM

PJS No.: MEC / 23ME / 05 / E5 / I / PJS-094 (RTU)
BID Doc No. : 05/51/23 ME /GAIL/094 (RTU)

Prepared & Issued by

ELECTRICAL &
INSTRUMENTATION SECTION
MECON LIMITED
DELHI - 110 092

0	31.05.2012	ISSUED FOR BID	Harsha	Rakesh	Pankaj
Revision	Date	Description	Prepared by	Checked by	Approved by

Table of Contents

1.0 Introduction
2.0 Brief Project Details
3.0 Brief scope of works
4.0 Completion Period
5.0 Bidders Qualification Criteria
6.0 Projection Requirements & Detail Scope of Work
7.0 General Technical Requirements
8.0 Area & Zone Classification
9.0 Power Supply
10.0 Earthing
11.0 Safety Requirements
12.0 Electromagnetic Compatibility
13.0 System Availability Requirement
14.0 Installation Material
15.0 Finish
16.0 Calibration
17.0 Minor civil area
18.0 Electrical Work
19.0 Spares
20.0 Test Equipments
21.0 Documentation
22.0 Functional Design Specifications (FDS)
23.0 Training
24.0 Warranty / Extended Warranty
25.0. QA / QC Requirements
26.0 Certificate Of Logistic Support
27.0 Supply & Storage Of Equipment
28.0 Site Preparation
29.0 Annexure

ANNEXURE I - SPECIFICATION OF REMOTE TELEMETRY UNIT (RTU)
ANNEXURE II - I/O COUNT FOR NEW RTUS
ANNEXURE III - INSPECTION & TESTING
ANNEXURE IV - INSTALLATION & COMMISSIONING
ANNEXURE V - P & ID FOR ALL STATIONS-KKBMPL-PH-II
ANNEXURE VI - PIPELINE SCHEMATIC ROUTE DIAGRAM (KKBMPL-PH-I & II)
ANNEXURE VII - TYPICAL INTERFACING OF RTU WITH OTHER PANELS
ANNEXURE VIII - SOURCE OF SUPPLY FORM (SOS) FORM
ANNEXURE IX - POWER CONSUMPTION & UTILITIES REQMT FORM (PUCR Form)
ANNEXURE X - PROJECT MANAGEMENT & RESPONSIBILITY (PMR) FORM
ANNEXURE XI - RESPONSIVE OFFER CRITERIA (ROC) FORM
ANNEXURE XII - TECHNICAL CHECKLIST
ANNEXURE XIII - LOGISTIC SUPPORT
ANNEXURE XIV - PROCEDURE/TEST SCHEDULE/FORMAT FOR THE TEST OF DNP 3.0 MAPPING / PROTOCOL / INTEROPERABILITY DETAILS
ANNEXURE XV - MODBUS RTU DATA FORMAT DETAILS TO BE PROVIDED BY RTU VENDOR
ANNEXURE XVI - DEVIATION FORM

1.0 INTRODUCTION:

1.1. The purpose of this specification is to define the outline requirement of Remote Terminal Unit (RTU) for Supervisory Control and Data Acquisition (SCADA) System for GAIL's Kochi-Kottanad-Banglore-Mangalore Natural Gas Pipeline – Phase II (referred as KKBMPL-PH-II) including all despatch terminal, Sectionalising Valve (SV) stations, Intermediate Pigging stations, Receiving Terminals used for RLNG transporting services**.**

1.2. In case of any conflict between the specifications, enclosed data sheets, enclosed attachments, related codes and standards etc. Vendor shall refer the matter in writing to the purchaser, and shall obtain clarification in writing before starting the manufacturing/ Supply / Engineering of the item. The decision of the purchaser shall be binding on the vendor.

1.3. Vendor shall be responsible for selection of the correct system to meet the purchaser's specifications. In case of any modification / change in selected equipment model has to be changed at a later date to meet the Purchaser's Specifications, the same shall be done by the vendor without any price and delivery implications.

2.0 BRIEF PROJECT DETAIL

M/s GAIL (INDIA) LIMITED has awarded MECON Limited as project management & consultancy services for laying 30"x90.615 Km.(Appx) & 24"x794 Km.(Appx) long pipeline in Phase-II in the state of Kerala, Tamilnadu & Karnataka for transportation and distribution of re-gasified LNG from tap-off cum dispatch facility at IP-1 of Phase-I pipeline.

The network will connect Kerala, Tamilnadu & Karnataka state. This Phase-II pipeline will be laid up to Bangalore & Mangalore. M/s Petronet LNG Ltd. is constructing the LNG re-gasification terminal at Puthuvypeen. Regasified LNG(R-LNG) from M/s PLL at Puthuvypeen has been considered as source for KKBMPL pipeline Phase-I & II.

The phase-II pipeline is designed to carry 10.0 mmscmd (appx) R-LNG.

PROJECT SCOPE

1) Laying of Pipeline in Phase-II.
   - Size 30"x90.615 KM Trunk pipeline from dispatch at IP-1 of Phase-I to Kottanad.
   - Size 24"x439.085 KM trunk pipeline from IP-1 of Phase-II to receiving terminal at Bangalore.
   - Size 24"x354.328 KM spur pipeline from IP-1 of Phase-II to receiving terminal at Mangalore.
2) Sectionlizing Valve (SV) Stations above three lines,
3) Intermediate Pigging (IP)Stations above three lines,
4) Dispatch/ receiving facilities/terminals above three lines.

To facilitate the operation, monitoring, control and maintenance of the pipeline, dedicated OFC / SDH telecommunication system/ network is proposed to be installed along the above-mentioned new pipeline. Optical Fibre Cable 24 Fibre , 6 fibre as per ITU T G655 & 18 Fibre as per ITU T- 652 shall be laid by Blowing Technique in ϕ 40 mm PLB HDPE Telecom duct by other contractor.

To ensure effective and reliable Control, Management and Supervision of the pipeline, the pipeline is envisaged to be monitored and controlled from existing Centralised SCADA system having Master Control Stations (MSs) located at GAIL, Noida and Back-up Emergency Control Station (BMS) at Jaipur. The MS / BMS will be interlinked with KKBMPL-PH-II Remote Telemetry Units (RTUs) located along the pipeline through FEP (Front End Processors) server by dedicated optical fibre communication system and Leased line links.

The tentative station wise I/Os are indicated in tender in ANNEXURE-II. The major IED (Intelligent Electronic Devices) to be connected with the RTU's through RS 232 / RS 485 are Flow computers, Gas chromatograph, LEL panel, cathodic protection panel, UPS panel/ Battery chargers panel of Solar Power Supply or Grid power supply along with some critical hardwired signal from instrumentation panels.

3.0 SCOPE OF WORK

This tender is for the procurements & commissioning of RTU for KKBMPL-PH-II with GAIL's Centralised SCADA system including all the related activities for interfacing with existing Centralised SCADA system. The proposed RTU by the bidder should be compatible to GAIL's Centralised SCADA system. However the interfacing work at existing MS & BMS will be executed by other contractor/GAIL. Any assistance required for hookup of RTU with existing Centralised SCADA System and commissioning of KKBMPL-Phase –II RTU will be in bidder's scope. The RTU will be multidropped and interconnected to the Front End Processor (FEP) SCADA Server (provided & installed by other contractor). Approx. 53 Nos. of Remote Telemetry Units (RTU's) for KKBMPL-PH-II Pipeline has been envisaged.

The Scope of work for bidder shall be to supply and commission RTUs for KKBMPL-PH-II pipeline with Centralised SCADA system which includes Project Management, Design, Engineering, Procurement of Materials, fabrications/ manufacturing, Inspection & Factory Acceptance Testing at works, Supply, Packaging, Shipping, Insurance, Port Handling, Custom Clearance, Inland Transportation to store & site, Storage & Safety, Installation along with necessary accessories, cables, connectors, RTU panels, erection of foundation support channel on trench for panel erection, cable trays, test instruments /equipments, Site Acceptance testing and integration with Centralised SCADA system, Test Run, Commissioning, Integration Telecom System & local IEDs , Training, Warranty & Extended Warranty, Mandatory & commissioning spares, Documentation etc. as specified in various documents attached with tender. The complete requirement as contained in the Bid Document shall be executed on turnkey indivisible works contract basis.

In case bidder is a subsidiary or authorized representative of the OEM of offered RTUs, then OEM shall assume the complete responsibility for the following as a minimum:-

a) Approval of QA / QC programs conforming to their own standards for carrying out the activities being proposed to be carried out by the bidder.
b) Provide logistic/technical support to the bidder during interfacing with Telecom system, IEDs & Centralised SCADA system.
c) Provide performance guarantee for offered RTUs.

Bidder shall provide the storage charges of extended period as per the SOR/MR. The storage charges shall be applicable & payable only if the work will not be completed in 22 months (16 months from FOI + additional 6 months of period). All the work has to be completed as define in the completion schedule. As evaluation will be on package wise basis hence this will be considered in the evaluation as per the terms & condition of the contract.

Bidder shall provide the rates for the extended warranty. This will be applicable & payable as define in respective clause elsewhere in the document. As evaluation will be on package wise basis hence this will be considered in the evaluation as per the terms & condition of the contract.

The scope of work for bidder to supply RTU for Centralised SCADA system which including but not limited to Design, Engineering, Procurement of Materials, fabrications/ manufacturing, Inspection & Factory Acceptance Testing at works, Supply, Packaging, Shipping, Insurance, Port Handling, Custom Clearance, Inland Transportation to site / store at site all inclusive for Remote Terminal Unit (RTU) along with RTU panels necessary software, and Supervision of Erection, , Pre-commissioning, Commissioning, Integration with Telecom System & local IEDs Site Acceptance testing & Integration with Centralised SCADA system and Trial Run, Warranty, commissioning spares, Documentation etc and shall be executed as per details in scope of work, Technical Specification of RTU – ANNEXURE-I to PJS, & various documents provided in the tender. For IO counts of typical Sectionalising Valve station, Intermediate Pigging Station, and Receiving Station type RTU, refer Annexure – II of PJS.

Price break- up as per the enclosed format 1 for supply and works shall be provided as per SOR/MR. This will be utilised for any addition or deletion of work as required during detailed engineering / future requirements.

Bidder shall note that the evaluation will be done package wise (all the items together) strictly as per the terms and the conditions define in the tender.

The complete requirement as contained in the Bid Document shall meet bid, its objectives, functional, specific requirements describe in the specification, taking care of complete P&ID requirement, operation & control philosophy. The specification shall be read in conjunction with scope of work, specification, drawings, documents and other requirements indicated in the tender documents.

4.0 COMPLETION PERIOD

Complete Scope for RTU of Centralised SCADA System at all the specified stations of KKBMPL-PH-II, shall be handed-over to the purchaser on turnkey basis after successful supply, installation, testing, commissioning, Integration with Centralised SCADA system , SAT and trail Run and shall be as define in the contract documents. The time schedule will be reckon from date of FOA (Fax of Acceptance).

5.0 BIDDER'S QUALIFICATION CRITERIA (BEC)- TECHNICAL:

This will be as define in the Vol - I of II of Bid documents. Bidder must fill the BQC provided at respective section without fail and provide all the necessary supporting documents along with offer, otherwise GAIL/ PMC reserves the right to evaluate the offer as per the terms & conditions of contracts.

5.1 EQUIPMENT QUALIFICATION CRITERIA (EQC)- TECHNICAL:

The RTU for Centralised SCADA System proposed to be supplied shall be from the existing range and should have successfully tested for similar application. If bidder is not a manufacturer of RTU then bidder has to provide the commitment letter from the OEM for offered RTU along with bid documents. RTU Vendor shall provide all the required configuration data, necessary support /assistance for interfacing with Telecom system, local IEDs & Centralised SCADA system and the supports for spares for next 10 year to client. Format of logistic support duly signed by the bidder and the OEM has to be provided along with bid.

5.2 COMPATIBILITY

The supplied RTU has to integrate with existing Centralised SCADA system; therefore, bidder's proposed RTUs shall meet the following requirements:

5.2.1 The centralized SCADA system is supplied by YOKOGAWA India limited**.** RTU has to be compatible with Yokogawa's Centrlized SCADA

The communication Protocol for RTU shall be standard DNP 3.0 (TCP/IP). For the compatibility testing bidder has to follow the test plan and procedure (enclosed as Annexure – XIV) suggested by YOKOGAWA for interfacing with GAIL's Centralised SCADA system.

5.2.2 **Before the bidding the compatibility testing has to be done and certificate has to be provided along with offer, without the compatibility certificate bidder offer may not be considered for further evaluation as per terms and condition of contract.**

To facilitate bidder for compatibility testing, GAIL will arrange testing at GAIL Noida. Following has to be done for compatibility testing certificate:

a) RTU Vendor (if bidder is not OEM then bidder along with OEM has to apply) shall apply to GAIL Project - SCADA Group, Delhi requesting for the testing of RTU with Centralised SCADA at MMS at GAIL Noida. The date for testing will be fixed one week prior to the testing.

b) The RTU vendor has to arrange their RTU along with required cables, connectors and other necessary equipments for testing at MMS, GAIL Noida.

c) The tests shall be demonstrated by RTU vendor as per enclosed test procedure (Refer annexure XIV)

d) After successful testing, certificate shall be issued by GAIL, Noida.

This compatibility testing certificate with test reports must be enclosed with bid documents.

5.3 During RTU FAT, RTU vendor/bidder shall call and involve Yokogawa engineer for witnessing the RTU FAT with Yokagawa Fast/Tools SCADA system at their cost. The testing will be done by YOKOGAWA India limited at RTU manufacturer's works. RTU vendor shall extend all the necessary testing facilities to YIL and do the necessary modification / programming as required.

The Modbus RTU data format details to be provided by the RTU vendor is enclosed as ANNEXURE- XV. (The Modbus details of the IEDs will be provided during detailed engineering to successful bidder. Functionality will be tested during FAT / testing).

6.0 PROJECT REQUIREMENTS AND DETAIL SCOPE OF WORK:

6.1 The Bidder shall undertake full responsibility for supply and commissioning of RTU for Centralised SCADA system in **KKBMPL-PH-II**, meeting the objectives, functional and specific requirements describe in the specification.

The material to be delivered and works performed shall be to meet the technical specifications and the requirements detailed in the Bid package.

6.2 GENERAL CONTROL AND FAILOVER PHILOSOPHY:

All the pipeline facility as define elsewhere for KKBMPL-PH-II shall be supervised and controlled by the Centralised SCADA operators of Master Control station (MS) at Noida and backup at Emergency Master Control Station (BMS) at Jaipur & also monitored at Remote Work Station located at all FEP locations tentatively at Mangalore, Bangalore & Kochi. All the despatch and Receiving station will be manned and all the SVs stations & IP Stations are unmanned. Local control system at these locations for various facilities communicated with SCADA system to allow remote monitoring and control from the Master Control Station and Emergency Master Control Station / RWS. The MS, RWS, BMS shall have dual redundant Ethernet LAN, distributed open system architecture having redundant processor, power supply and storage devices.

6.3 The system will be based on the concept of Open system Interconnect (OSI) architecture maximising the use of international standard interfaces. The SCADA system shall communicate to individually IP addressed RTU / Device on dedicated OFC network and some of the RTU / device may be on GSM / leased line network. **Backup communication link between MS and BMS /RWS will be provided by Independent leased line provided by the independent service provider (arranged by the client).**

6.4 The material to be delivered shall meet the technical specifications and other requirements and performed at site as defined in the tender.

6.5 One RTU shall be provided with redundant GSM (Hot standby 1+1 configuration) Modem having capability for polling (read and write) to Flow Computer through either dialup / GPRS. The dial up RTU (any one from the supplied RTU) to be hooked up with the GSM Modem shall be conveyed during detailed engineering. All the necessary software/hardware and program for getting data through dial-up has to be supplied by the bidder. Also the bidder has to demonstrate the dialup functionality for one FC through redundant GSM/GPRS modem during FAT/SAT.

6.6 The RTUs shall be provided at all SVs, IPs, Despatch and Receiving Terminals for remote monitoring and control as per the requirements. **The each RTU shall have additionally 04 nos. of RS 485 and 04 nos. of RS 232 Serial ports as spare for communication in future over & above the requirements indicated in I/O list enclosed with ANNEXURE-II to PJS and Technical specifications of RTU ANNEXURE-I.** The requirements of internal communications between the RTU CPU module and RTU I/O modules is to be taken care separately while designing and sizing of RTU. The details of configuration of each port will be provided in detailed engineering. **Any serial port present at CPU cards will not be considered spare.**

6.7 Communication protocol between MS / BMS / RWS and RTUs shall confirm to OSI Communication model,

DNP 3.0 (TCP/IP) and it will be standard protocol for all the station communications.

6.8 RTU Vendor shall ensure the completeness of the Bill of materials / Schedule of Rates (SOR) to meet the complete requirements of this tender as part of their responsibility and any change / modifications required for the same during detailed engineering to meet the requirements of the tender shall be done by the Vendor without any delivery & cost implications to the Client.

6.9 The bidder shall carry out the activities related to project management, system design, engineering, integration, configuration, training, testing fully by themselves and the remaining activities may be sub-contracted to any other agency having experience in erection, cabling, installation of RTU with SCADA system.

6.10 In the tender, the terms Owner, GAIL, Purchaser, Company and Client been used synonymously. The terms Contract document, Contract specifications, tender specification have been used synonymously.

6.11 The Bidder shall give an undertaking in line with PMR form enclosed as Annexure to PJS that system support for maintenance, upgradation and enhancement/expansion shall be **provided for 05 years** and spare part support shall be provided for the **period of 10 year** of the offered RTU from the expiry of the Warranty period. The ROC form as per Annexure of PJS and source of supply (SOS) as per Annexure of PJS has to be furnished with bid. In addition to warranty bidder shall quote for extended warranty as defined in the tender & SOR.

6.12 Bidder shall furnish all documentation, drawings, and other information required Operation and Maintenance Manuals, Handbook of inventory of all the equipment supplied and installed.

6.13 Bidder must have coordination with Instrumentation / Telecommunication / Electrical / CP system contractor / KKBMPL-PH-II and Centralised SCADA system vendor (YIL) during installation & commissioning for proper integration.

6.14 The electrical works associated with the installation and commissioning (define elsewhere) and earthing of RTU equipments at all sites (from Earth pit to RTU), powering of equipments at all sites, termination of cables as required. Separate earth pits if required shall be provided by Client /other contractor.

6.15 At the RTU locations, UPS power at single point shall be provided by Client. Further lying of power cables, PDB and distribution to individual equipments is in the scope of bidder.

6.16 Supply and laying of cables & connectors from TIC/ Instrumentation panel to RTU & interconnection between RTU with Telecom system.

6.17 Glanding, ferruling, termination of instrumentation signal cabling at RTU end and respective end at TIC/ Inst Panel end. The cabling from field devices up to TIC panel (including supply of panel & cables) will be carried out by Client /other contractor.

6.18 IEDs communication protocol details will be provided by Client during detail engineering.

6.19 The type of telecom connectivity shall be Ethernet based TCP/IP for each remote location; if any change, it will be communicated during engineering by Client.

6.20 Scope regarding cables, glands and interconnection of cabling and accessories including cable routing between the following cabinets/ equipments are as follows:

	Type of Cabling	Location	From	To	RTU vendor
1.	Serial Interface cables (RS 232/RS 485)	RTU locations	RTUs.	IEDs (FC, GC, CP, LEL etc) at Remote locations	Complete interfacing requirements including supply of cables with connectors at IED end, modem end, and RS 232C / RS 485 intrinsically safe box (ISB) ends.
2.	Power cables	RWS / RTU locations	Power Distribution cabinet	RTU	Supply of cable including glanding, termination, ferruling, dressing etc. at RTU / RWS end.

3.	Telecom Interface Cable	RWS / RTU locations	Telecom panel / router / switch	Ethernet port of RTU / RWS / Lease line modem	Supply, Laying, routing, glanding termination both end.
4.	Instrumn. Cables	RTU Locations	TIC Panel	RTU	Glanding, ferruling, termination of instrumentation signal from TIC to RTU, both ends**.** The cabling from field devices up to TIC, Inst panel to TIC will be carried out by Client / Other Contractor.

6.21 Vendor shall consider separate cable for each type of digital and analog signals. Over all & individually shielding cable for analog signals and over all shielded for digital signals. Necessary tray, Glands, other erection accessories as required has to be supplied.

6.22 **BATTERY LIMIT WITH OTHER CONTRACTORS**

SI. No.	Item	Scope of Pipe Laying Contractor or other contactor	Scope of RTU Vendor
1.	Cathodic Protection (CP)	Supply & laying of cable for hardwired signals (which shall be interfaced with RTU) from CP panel to Inst/ TIC panel including glanding, termination, ferruling, dressing etc. both end	Supply & laying of cable for hardwired signals / serial communication from Inst /TIC panel to RTU including glanding, termination, ferruling, dressing etc. both end
2.	Fire & Gas Detection System	Supply & laying of cable for hardwired signals (which shall be sent to RTU) from Fire & Gas panel to TIC/INST panel including glanding, termination, ferruling, dressing etc. both end	Supply & laying of cable for hardwired signals from TIC/INST panel to RTU including glanding, termination, ferruling, dressing etc. both end
3.	Door Switches	Supply of Door switches & Supply & laying of cable for hardwired signals (which shall be sent to RTU) from Switches to TIC/INST panel including glanding, termination, ferruling, dressing etc. both end	Supply & laying of cable for hardwired signals from TIC/INST panel to RTU including glanding, termination, ferruling, dressing etc. both end.
4.	Corrosive Monitoring System	Supply & laying of cable for hardwired signals (which shall be sent to RTU) from CMS to TIC/INST panel including glanding, termination, ferruling, dressing etc. both end	Supply & laying of cable for hardwired signals from TIC/INST panel to RTU including glanding, termination, ferruling, dressing etc. both end.
5.	Hardwired Signal Cable for field instruments (field I/Os)	Supply of cable & laying of cables from field instruments to JB, JB to TIC/INST panel including, gas actuated valve & manual valves to TIC/INST panel including glanding, termination, ferruling, dressing at Panel end.	All the hardwirded signal of field instrument / IEDs from TIC to RTU .
6.	Soft Signals from TIC/ INST to RTU	Provide modbus details to RTU/SCADA vendor	Supply of communication cable with connectors at both ends from TIC/INST to RTU including glanding, termination, ferruling, dressing etc. at TIC/INST cabinet end and laying of the same cable up to RTU cabinet also Configuration at RTU end by RTU vendor
7	Solar System	Supply of solar system & provision for RS485 in Solar system for interfacing with RTU by Solar panel vendor also provide modbus details in modocon modbus format to RTU/SCADA vendor.	Supply of communication cable with connectors at both ends from Solar panel to RTU including Laying, glanding, termination, ferruling, dressing etc. at both ends.

Note:

(i) Distance between Telecom Panel and RTU equipment at stations and RWS shall be considered as 15 meters. However, these distances shall be firmed up during detail engineering.

(ii) Distance between IEDs/ TIC / CP /Solar and RTU Panel to be considered as 30 meters. However, these distances shall be firmed up during detail engineering.

(iii) RTU vendor has to supply & lay the cable tray, supply & erection of foundation channel on trench provided by client as required.

(iv) All the serial cables shall be laid in the conduits from various panels to RTU.

6.23 All the signals from CP panel, door switches, CMS system and Fire & gas detection system shall connect with RTU through hardwired signal or serial communications (on MODBUS) as per the provisions available in the respective panels. If the signals are not available then it will be treated as spare I/os.

6.24 Cable trench in the control room will be provided by client. However support channel erection on trench as per panel base frame will be in bidder's scope.

6.25 Bidder shall provide the information / documents as built document. Bidder's offer, catalogues, drawings, instrument manuals etc. shall be in English.

6.26 Supply of all the items / equipments including test equipments, software, installation materials, spares etc. required to execute the complete system in all respects. However, if any additional items are required to meet the functionality of the system as per this tender, vendor shall supply the same without any cost and time implication.

6.27 Vendor shall provide all the RTU configuration details, communication Protocol details & assistance required for KKBMPL-PH-II SCADA vendor (M/s YIL) during interfacing & commissioning.

6.28 The system shall meet the requirements of interoperability, portability and scalability as per the international standards (latest version).

6.29 RTU shall be interfaced with existing SCADA via telecom system on dual channel terminology and should support / compatible to DNP 3.0 (TCP/IP) protocol.

6.30 RTU Vendor shall provide all the required configuration data and necessary support /assistance during interfacing with Telecom system & SCADA system.

6.31 Vendor to note that though DNP 3.00 (TCP/IP) is a standard protocol, in case any further details are required for configuration, integration or during design of RTUs with the existing SCADA system the same has to be obtained from the original supplier M/s Yokogawa India limited, Bangalore by the vendor as required.

6.32 For telecom system vendor shall design the RTU which can support the IP base telecom system and provide IP port (two numbers,). RTU will poll through both the ports from two FEP servers simultaneously.

6.33 It is the prime responsibility of RTU vendor to establish communication between RTU, Telecom and SCADA. During interfacing stage if any extra item would require from RTU end which was not ascertained by RTU vendor during bidding stage shall make available with out any implication of extra cost to client.

6.34 RTU panels testing shall be carried out as per the following stages.

A) Real data testing of all the serial interface signals from respective panel to RTU with Centralised SCADA.
B) Real data testing of hardwired signals from respective panel to RTU with Centralised SCADA.

6.35 The person deputed for erection and testing shall be competent to execute the work independently.

6.36 Portable Programmable Diagnostic Unit (PDT), shall be provided as per the specification / with Latest configuration with minimum 1 USB & 1 RS232 port & as define in the specifications.

6.37 Test equipments as per specification with Latest configuration as per the SOR /MR.

6.38 Vendor shall provide Mandatory spares as per the SOR.

6.39 The test jigs RTUs (two – one for Noida & one for Bangalore) of same make and model as proposed RTU for testing purpose and shall be confirm during detailed engineering. One for Bangalore shall be supplied along with mounting cabinet of size 800 mm (W) x 800 mm (L) x 600 mm (H) and for Noida with 19" rack only. If order will be placed on the vendor who is already supplied RTU to GAIL and test Jig is available at Noida then only one test Zig RTU is to be supplied i.e for Bangalore. Accordingly the same should be kept in the scope.

6.40 Storage & Safety of the equipment at site is in vendor's scope. However for extended storage, it will be reimbursed as per the terms & conditions of contracts define in the contract.

6.41 Performing all works required for designing, engineering, testing, supply, installation, interfacing with the communication channels, IEDs and instrumentation & electrical systems, etc, commissioning (with supply of commissioning spares including consumables), site testing, test run and putting into commercial operation of the system complete in all respects.

6.42 The civil works associated with the installation of supplied equipments at various stations as define elsewhere. This includes restoration works at various stations as necessary.

6.43 Vendor shall note that inspection will be done by Client / MECON Personnel at Vendor's shop. For this inspection, labour, consumables, equipment and utilities as required shall be in vendor's scope or as define elsewhere in the tender documents.

6.44 Training to Owner's/Owner' Representative in the operation, maintenance, system internals and expansion/modification of the installed RTU system shall be provided.

6.45 RTU vendor shall prepare and submit final terminal details along with final IO list as per the FORMAT (to be provided by GAIL) and to be approved by PMC/GAIL before pre commissioning.

6.46 The RTU vendor shall inform GAIL about product discontinuation one year in advance so that GAIL can procure the spares of the RTUs to maintain it for its remaining useful life. If bidder is not RTU manufacturer then the RTU manufacturer should give a letter that they intimate GAIL about discontinuation of product one year in advance along with the bidder's commitment.

6.47 SPARES:

Supply of Mandatory spares and Commissioning Spares of all supplied RTU shall be provided as per the following:

a) <u>MANDATORY SPARES (Lump-sum against SOR/MR – A.4.a)</u>

Supply of loose Mandatory spare shall include 10% of all type of Installed cards, convertors, power supply/converters, termination boards, OEM cables between cards and termination boards, backplanes, relays etc accounted & calculated considering total quantities of RTU (53 nos). **In case total installed cards/items are 1 or 2 then only one spare card/item shall be provided. Bill of material of fully wired RTU (with spare calculation) must be furnished along with offer. (Bill of Material has to be provided along with offer, any fraction quantity should be round off to nearest number in higher side).**

Unit rate for Mandatory spares with cards details, part no., make etc. shall be given separately with the offer & price part.

Vendor has to note that mandatory spares, supplied to GAIL, shall not be available to them as part of commissioning spares.

For spares Vendor shall provide the address, contact person, fax and telephone numbers of the manufacturer for spare parts. The vendor shall warrant that spare part for the system would be available for minimum of 10 years after warranty period from the date of system commissioning. After this period if the vendor discontinues the production of the spare parts, then he shall give at least 12 months notice prior to such discontinuation so that Owner may order the requirements of spares in one lot.

The Vendor shall provide unit price of each Spare Module card, which shall be valid for the procurement of the spares for operation and maintenance in subsequent years as & when requested or during detailed engineering.

b) COMMISSIONING SPARES:

The commissioning spares shall be arranged by the vendor to cater to the needs/requirement during installation, commissioning, site acceptance testing, trial run and warranty period. These spares will be the part of the tender. These spares shall be readily available with the vendor. If the spares not used they may be retained by the vendor for maintenance.

These commissioning spares are different from Mandatory spares and vendor shall not use mandatory spares as commissioning spares. Vendor shall provide a list of commissioning spares (with Serial & Part number for each system, sub-system) at the time of offer and it will be part of main offer.

6.48 **EXCLUSIONS**

Work such as civil work related to building, Electrical panel, Instrumentation panel, supply and erection of these panels in control room, Trench in control room, Preparation of buried cable trenches and laying of multi-cables which is outside the vendor's scope. However vendor shall be responsible for Erection of foundation channel on trench for RTU supply and laying of cables from TIC/ instrumentation panel / other respective equipments to RTU, Cable tray, complete loop checking related to RTU/SCADA and final documents. The work for MS & BMS will be in other contractor scope. However any assistance required at KKBMPL-PH-II pipeline site will be in bidder's scope for interfacing work.

7.0 GENERAL TECHNICAL REQUIREMENTS:

7.1 REFERENCES

7.1.1 Codes and Standards

The following standards shall be considered part of this specification insofar as they give definitions, describe requirements and provide tests that the equipment supplied shall meet. The Standards used shall be the latest revision in force, including any addenda, supplements or revisions thereto.

International Standards

API

- API 1113 Developing a Pipeline Supervisory Control Centre
- API 1130 Computational Pipeline Monitoring

ANSI

- ANSI/NFPA 75 Standard for the Protection of Electronic Computer Data Processing Equipment

NEMA

- NEMA ICS General Standards for Industrial Control and Systems

- NEMA ICS 2-230 Components for Solid-state Logic Systems
- NEMA ICS 3-304 Programmable Controllers
- NEEMA ICS-6 Enclosures for Industrial Controls and Systems

IEC

- IEC 61131 Programmable Controllers- ALL PARTS
- IEC 60870-5-101 Telecontrol equipment and systems – Part 5 – 101: Transmission Protocols – Companion standard for basic telecontrol tasks

ISA

- ISA S5.1 Instrumentation symbols and identification
- ISA S5.2 Binary Logic Diagrams for Process operation
- ISA- 5.3 – 1983 Graphic symbols for Distributed Control/ Shared Display Instrumentation, Logic, and Computer systems
- ISA S5.4 Instrument loop Diagrams
- ISA-5.5-1985 Graphic Symbols for Process Displays
- ISA S18.1 Alarm annunciation sequence and specification
- ISA-50.02 Fieldbus Standard for use in Industrial Control Systems Part : 2 Physical Layer Specification and Service Definition
- ISA RP55.1 Hardware testing of digital process computers
- ISA-RP60.3-1985 Human Engineering for Control centres
- ISA S71.04 Environmental conditions for process measurement and control System: Airborne contaminants
- ISA S72.1 LAN Industrial data highway
- EWICS-1998 Guidelines for the use of Programmable Logic Controllers in Safety – Related Systems
- EWICS-1997 Guidelines for Achieving Safety in Distributed Systems

Indian Standards

- IS 732-1989 Code of Practice for Electrical Wiring installations
- IS 3034-1993 Fire Safety of Industrial Buildings: Electrical, Generating and Distribution Stations- Code of Practice
- IS 3043 Code of Practice for Earthing
- IS 5572-1994 Classification of Hazardous Areas (other than mines) having Flammable Gases and vapours for Electrical Installation
- IS 5887-1916 Classification of Maximum Surface temperatures of Electrical Equipment for use in explosive Atmospheres

Other Standards

- API MPMS 12.2 Calculation of petroleum Quantity Using Dynamic Measurement Methods and Volume Correction Factors
- IEEE 472 Guide for surge Withstand Capability
- IEEE C37.1 Automatic and Supervisory Station Control and Data Acquisition
- IEEE 730 Software Quality Assurance Plan
- IEEE 830 Software Requirement Specification
- IEEE 802.3 Standard CSMA/CD Media Access Control (Ethernet)
- IEEE 829 Software Test Documentation
- ANSI MC8.1 Recommended Practice Hardware Testing of Digital Process computers
- ITU V.23 Modern VF Interference
- ITU V.24 DCE/DTE Interface
- BS 5345: Part 4:1977 UK Code of Practice for Intrinsic Safety
- BS 5501: Part 6:1977 Intrinsic Safety ‘e’

- BS 1259: 1958 Intrinsic Safety Standard
- EIA-232 Interface between Data terminal equipment and data communication equipment employing serial binary data interchange
- EIA-422 Electrical characteristics of balanced voltage digital interface circuits
- EIA-485 Electrical Characteristic of generators and Receivers for use in Balanced Digital Multipoint Systems
- ISO/9001/02/03 Quality system for Design/Production and Installations/ Final Inspection and testing
- MIL-STD-461B Radio Frequency and Electro-magnetic Interference.

7.1.2 **Abbreviations**

AMS	Alarm Management System
CP	Cathodic Protection
DCS	Distributed Control System
DHCP	Dynamic Host Configuration Protocol
EPAX	Electronic Private Automatic Exchange
ESD	Emergency Shut Down
FEP	Front End Processor
FIFO	First In First Out
FMC	Field Marshalling Cabinet
GIS	Geographical Information System
GMS	Gas Management System
GOV	Gas Operated Valve
GPS	Global Positioning System
IS	Intrinsically Safe
LAN	Local Area Network
LDS	Leak Detection System
MS	Master Control Station
MIS	Management Information System
HMI	Human Machine Interface
MOV	Motor Operated Valve
MTBF	Mean Time between Failures
MTTR	Mean Time To Power
OPC	OLE for Process Control
P&ID	Piping and Instrument Diagram
PLC	Programmable logic Controller
RAID	Redundant Array of Independent Disks
RTU	Remote Terminal/ Telemetry Unit
RWS	Remote Work station
SCADA	Supervisory Control and Data Acquisition Unit

SCSI Small Computer System Interface

EMS Emergency Master Control Station

TSS Training Simulation System

UPS Uninterruptible Power Supply

WAN Wide Area Network

7.2 **GENERAL SITE INFORMATION:**

All the equipment supplied under this contract shall be suitable for continuous operation under the environmental conditions prevailing at site. It shall be suitable for operation under the following site conditions:

Sand & Dust :

With a built up of dust on operational surface to a level such as may occur because of imperfections in the sealing of equipment, housing and conditions prevailing in sub-tropical dust conditions.

Tropicalisation :

The equipment shall be fully tropicalised

Shock & vibration :

The equipment shall withstand transportation and handling by air, sea and road under packed condition confirming to standards, confirming to MIL 810 B specification or commercial equivalent.

The equipment shall also be resistant to termite, fungus, rodents and salty environments.

7.3 ENVIRONMENTAL SPECIFICATION OF EQUIPMENT TO BE SUPPLIED

All the other RTUs at unmanned stations (at remote locations) shall be designed for storage and operation under the non air conditioned environment with the limits given below.

FOR	TEMPERATURE	HUMIDITY
Operation	0 to 55°C	10 to 95 % RH
Storage & transportation	0 to +60 °C	5 to 95 % RH

7.4 All equipment to be supplied shall withstand international standards of vibration for industrial application.

8.0 AREA AND ZONE CLASSIFICATION

The RTU installation and other Telemetering panel located in control room are specified as safe area.

9.0 POWER SUPPLY

9.1 Electrical power supply shall be provided at one point inside the battery limit as per the details provided below. If any other voltage levels are required, then all necessary conversions shall be in the scope of Vendor.

Vendor has to provide Station wise power consumption for the RTU along with the bid.

Location	Power Source	Power Supply / Watts
RTU location	UPS (Grid+ Solar Panel)	24 V DC, 250 Watts; Non UPS 230 V AC for Utilities socket

9.2 RTU vendor shall furnish power consumption details with detailed break-up for each subsystem/equipments including inrush current and its duration during detailed engineering. Refer I/O list (ANNEXURE – II) for details of station wise power supply.

9.3 Reliable and rugged SMPS power supply shall be supplied as required with equipment to generate isolated and stable voltage levels required for equipment operation.

9.4 **SURGE PROTECTION, TRANSIT SUPPRESSORS, RFI FILTERS**

All the equipment shall be designed with built-in safety to protect against the effects of monitor induced high voltages, effects of surges, transients (RF)

Necessary surge protection devise shall be provided as per the recommendation of the equipment supplier for all the power supply / signals.

10.0 EARTHING

10.1 Each supplied RTU cabinet shall be provided with earthing lugs with their frames. All these lugs/ strips shall be properly secured to the electrical earthing bus.

10.2 All the system ground of various cards and equipments, shields of instrument cables shall be connected to system ground bus which is electrically isolated from the AC mains earthing bus. The equipment shall provide separate earthing strip for the same. The system ground bus shall be connected to independent ground buses through insulated wires.

10.3 Bidder shall note that for RTUs, separate earthing shall be provided by the Client for:-

a) System grounding (Earth resistance less than 2 ohm)

b) Frame and AC mains grounding (Earth resistance less than 5 ohm)

Accordingly the RTUs shall provide separate earthing strips as mentioned above and vendor shall also take care of onwards earthing connections from equipment to earthing strips provided separately in the respective rooms.

10.4 Following guideline shall be considered while doing the earthing work:

a) Panel metalwork- electrical AC mains supply earth – 2 off M10 brass studs per panel section. These brass studs shall be fitted with vibration proof nuts and washers.

b) Instrument “Clean” earth – electrically insulated copper bus bar 75 mm2 minimum separated from the panel metalwork by 25mm minimum. 2 off M10 brass earth studs to be provided at each end of the bars with associated shake proof nuts and washers.

c) An intrinsically earth bar similar in construction to the instrumentation clean bar shall be installed. This bar shall comply entirely with the requirements of IS 3043. The bar shall incorporate a removable section to facilitate earth continuity testing.

On intrinsically safe circuits the following shall be considered:

- Unused cores of the multicare cables nominated as spares shall be terminated to earth via dummy barriers. All other unused cores shall be taken directly to the I.S. earth bar.
- The earth connection via dual shake proof screws or clamps.
- Brass studs shall be incorporated on the I.S. earth bar for connection of dual I.S. earth cables.
- The I.S. earthing system shall be labeled “Safety earth-Do not disconnect”.

Similarly unused cores of Non- I.S. field cables and system cables shall be terminated and connected to the instrumentation “clean” earth. A minimum of 30 % spare capacity shall be provided within system cables and ELCO connectors.

11.0 SAFETY REQUIREMENTS

11.1 It is the intent of the Client that operational hazards be reduced to a minimum. The bidder shall use sound engineering judgment to complete an installation that will perform the required function without compromising this aim.

11.2 All controls shall be in fail-safe mode. A fail safe mode is defined as a plant equipment or system fail it shall be safe to the system.

11.3 Provision shall be made to isolate all 230 V AC incoming signals to a cabinet (for utility socket on RTU) before gaining access to cabinet internals. Shrouding terminal with warning labels shall be provided with these terminals being segregated from other incoming terminals. Non UPS 230 V AC will be provided separately by client.

11.4 RTU vendor must ensure that the equipments will not be damaged due to blackouts / burnouts.

11.5 RTU vendor shall provide the start up procedure of the system. Further RTU vendor to indicate steps to be taken for fail safe operations of the system under following criterion

A) power failure
B) voltage variation more that ± 10%
C) frequency variation more than ± 3%
D) Air Conditioning Failure

12.0 SYSTEM AVAILABILITY REQUIREMENTS

12.1 The vendor shall ensure the system availability shall be 99.98 %

12.2 The vendor shall ensure that the MTTR of RTU as 8 hrs and MS equipments as 2 hrs.

12.3 System Design covering future expansion takes calculation of availability in to account

13.0 ELECTROMAGNETIC COMPATIBILITY - EMC

13.1 The equipment shall be efficiently screened against EMI, RFI and conductive interference and shall not interfere with other equipment in the vicinity or installed in the same building.

13.2 The equipment shall be required to meet one of the relevant EMC standards (IEC, MIL, VDE, BS, IEEE etc.).

14.0 INSTALLATION MATERIALS

All installation materials such as ac and dc cables, telecom interface cables, serial interface cables, data cables, all necessary cable trays, relays, connectors, switches, fuses, terminations, distribution boxes and other items required but not mentioned herein shall be provided by the RTU vendor.

Vendor to note that detailed scope of cables including power cables with other accessories for interfacing with different equipments shall be supplied by the vendor.

The quality of materials used shall be of the highest order and shall conform to the international standards and safety standards as per relevant hazardous area classification.

Trench in the control room will be provided by client. However, erection/ welding/ foundation channel to suit the RTU base frame and grouting is in vendor's scope.

15.0 FINISH

Shall be as follow:

All the frame and the steel work of the cabinets shall be degreased then phosphate treated or coated with primer followed by at least two undercoats and a final coat of matte finished enamel paint of light admiralty grey color (IS 697) or as per RAL 7035.

The finished of the equipments shall be of the finest quality and capable of long and unattended service. The inside of the cabinets shall be painted pale cream color (IS-352) or RAL 7035. Vendor shall take approval of the shade or other different shade during detailed engineering. Shade of the plinth shall be as per RAL 7022.

All the RTU cabinets shall have 'Nameplates' correlating with the type and location of the cabinet at both front & back side.

16.0 CALIBRATION

The calibration procedure along with periodicity required for ensuring the accuracy of test instruments supplied under this contract shall be taken care by the vendor. The vendor shall supply calibration charts from independent test laboratory for all input/output subsystems, during the warranty period.

17.0 MINOR CIVIL WORKS

For RTU locations, civil work shall consist of:

a) Civil works required for interconnecting cabling at control rooms between various systems & equipments [RTUs] with telecommunication system and the power supply unit along with cable routing and dressing.
b) The cable trenching work will be done by other Contractor. Erection of foundation channel to suit the RTU base frame requirement shall be done.
c) Associated grouting and fixing of equipment.
d) Providing and laying perforated trays etc. for point a) above if required
e) Any masonry work associated with entry and ingress of equipment inside the control rooms including making goods and finishing such masonry work.

18.0 ELECTRICAL WORKS:

Electrical work associated at all the stations shall be consisting of (but not limited to):

1. All the cable work including earthing up to the panel from the dedicated Earthing point/ Earthing pit, system grounding for the supplied equipments.
2. Any temporary electrical works associated with the erection & commissioning of the system
3. Testing and certification of all the electrical works within the scope.
4. All power cabling (including supply of cables, glanding, cable tray, ferruling, termination etc.) from the power distribution cabinet to the RTU shall be carried out by vendor.

19.0 SPARES:

The vendor shall cover the various categories of spares included corresponding activity / services as listed below as part of Lump sum price:

a) Commissioning spares including consumables as part of commissioning activities.

b) Vendor must ensure availability of following commissioning spares as a minimum at site:
2 nos of CPU, 2 nos. of each I/O's cards (AI, AO, DI, and DO) of RTU, one no. of each type of communication card, Power cables, converter and connectors.

c) The mandatory spares (as per SOR) shall be supplied as per the contract. These spares can't be used during commissioning. Any mandatory spares utilized by the RTU vendor during Warranty period shall be replenished within 45 days.

20.0 TEST EQUIPMENTS:

20.1 Vendor shall include adequate test equipments & tools for testing, calibration as required for supplied items.

20.2 Vendor to supply 6 nos of licensed software needed for configuration and programming of RTU, Diagnostics software for RTU along with necessary cables/connectors, documentation and accessories. All the supplied software should be licensed to GAIL. Two set of software to be installed in PDT and other to be installed at Server/Workstation in Noida, Bangalore, Mangalore, and Kochi. Software should have provision for remote configuration/download of configuration to RTU through RTU polling channels from MS.

20.3 Portable Programmable Diagnostic Test Unit (PDT Unit) shall be supplied with latest configuration. The PDT shall be latest Intel Pentium with active matrix display and fully configured and loaded with all the RTU configurations and diagnostic software. All the necessary cables and connectors shall be supplied with the PDTs.

MINIMUM SPEC FOR PORTABLE PROGRAMMABLE DIAGNOSTIC TEST UNIT (PDT UNIT):

The hardware shall be provided from proven sources (hand held service terminal equipment of Manufacture / Laptop computer from LENOVO /HP/DELL)

It shall be possible to use the PDT both locally and remotely to manage SCADA system. Provision for local accessibility at each equipment shall be provided along with all hardware /cable etc available at each station.

The PDU shall be provided as per the following minimum specification (For any discrepancy / conflict with specification, higher specification will prevail)

Make	: HP/ LENOVO/DELL
Processor	: Intel core i5 , Min 2.3 Ghz integrated cache
Chipset	: Intel 845MP Chipset
RAM	: 4 GB, DDR SD RAM, 266 MHz
Keyboard	: 87 key or higher
Display	: 15” LED active screen or higher Active color monitor
Mouse	:Touch point/Touch pad / Pin typet
Port	: 3 USB/ 1 parallel/1 serial / S Video out / Integrated wireless Blue Tooth/ External speaker/ External mic / Line in/ External monitor/ RJ-11& RJ-45
Slots	: One type II
Display	: AGP 4 x with min.16MB RAM, Dedicated Video card with 512 MB RAM
HDD	: Minimum 500 GB
Smart LAN /modem	:10/100Mbps Ethernet and 56.6Kbps Modem , wireless LAN, 820.11 b wireless Connection 10BASE- T/100BASE- TX Ethernet with RJ-45 interface
DVD – CD RW Drive (Swappable with FDD)	: 8 x min with auto disc cleaner and lens cleaning Cartridge
Weight	: less than 2.9 KG
Operating System	: Latest Window OS with Documentation & recovery mechanism, Office XP CD with license and media.
Manageability	: DMI /PC 2001 WI - FI certified state of art Management features
Anti-virus	: Latest Antivirus with license for virus definition free update till 3 years.
	: Latest MS Office suite
Accessories	: Leather carrying case, AC adaptor 240VAC 50Hz.
Battery	: Battery backup for M 3 Hours (Min) with additional battery pack

RTU configurator/diagnostic software shall have the following provision:

i. DNP index of all I/O along with hardware details and present value in single table/window.
ii. All RTU cards, serial ports and communications channels health points are to be configured in RTU and DNP index of same are to be reflected in I/O list and all serial ports should be independently configurable.
iii. Error detection/control feature to ensure data integrity.

20.4 **Portable Power Source cum Calibrator (Voltage & Current):**

Portable Power Source cum Calibrator (Voltage & Current) for simulating signal source and measurements function for current (min 4-20 m Amp) & voltage (1-5 Volt) make YOKOGAWA CA11E or equivalent.

The calibrator shall be operable on RTU power supply Voltage level (Both 24 V and 230 V AC). The calibrator shall be self contained and complete in all respects with power supply (230V AC chargeable adapter), cards termination/ connectors, interconnecting signal and power cables and connectors with carrying case. Calibration certificates shall be included

20.5 **4 ½ Digit Multi-meters:**

4 ½ Digit Multimeter with built-in signal level meters and with carrying case [to measure accurately and serve the function of measurements of DC voltage, AC voltage (True – RMS), resistance, conductance, frequency Test leads, probe holder, alligator clips, batteries, user manual and calibration certificate shall be included]. Preferred Make shall be Tektronix, Fluke, Agilent Technologies, Falcon.

20.6 **Protocol analyser**:

Protocol analyser shall be supplied with necessary software to diagnose and troubleshooting in networks. The analyser should be able to monitor (line and buffer), simulate different industry related protocol and shall provide detailed timing, raw data and messaging information for serial, and ethernet networks. The analyser shall have provision to monitor, diagnose and simulate minimum modbus (serial/ip) , dnp (serial / ip) protocols. Communication setting in the analyser shall be user defined and can be set by the user. The analyser shall be provision to be configured both as master or slave.

21.0 DOCUMENTATION

Vendor shall furnish all the documents as per VENDOR DATA REQUIREMENT.

The language used in all correspondence, documentation, literature, drawings, markings etc., shall be English.

Vendor shall furnish all relevant technical manuals, literature and other technical data as required at the various stages of the project indicated in tender.

All the drawings and documents shall be verified by the vendor before presenting the same for Client review.

All these documentation shall be furnished in hard cover loose ring folders in A4 size (210mm x 297 mm).

All documents shall also be supplied in “SOFT COPY” form. However document submission date will be considered the date of actual hard copy received from vendor at PMC/GAIL office.

All the drawings and documents shall be verified by the SCADA vendor before presenting the same for Client review. For initial submission 3 set hard & soft shall be submit till the approval. 6 sets of CD & prints of “As BUILT FINAL” documents shall be submitted.

RTU engineering documents (FAT, engineering manual, user’s manual, engineering will be submitted for review/approval/records.

The contract document would be the Purchase order (after award of contract) and the same shall have higher precedence than all approved project documents.

All the PO, FDS, FAT cum Inspection Certificates, SAT and Warranty, Guarantee / warrantee etc documents will be part of the "Final Documents".

22.0 FUNCTIONAL DESIGN SPECIFICATIONS (FDS)

Vendor has to note that this tender completely covers the operational and functional requirements of the RTU for Centralised SCADA system for GAIL's KKBMPL-PH-II pipeline and associated network. The requirement of FDS shall be to focus on the implementation aspects of requirements specified elsewhere.
FDS shall be custom defined for this project and include the implementation aspects of tender requirements in the following sections.

FDS shall cover operational and functional requirements of SCADA implementation aspects within the scope of this tender [Complete details of systems configuration, control philosophy, Redundancy and backup aspects (system failovers & fail backs), alarms management covering implementation aspects of tender requirements, Interfacing, Integration and communication aspects between various subsystems including with Telecom system, communication protocol interfacing with Flow computers, GC, CP Panel and other IEDs, description of SCADA/ third party software interface, system resource sizing basis and performance parameters covering CPU, Hard disk and main memory utilisation, memory mapping, system timeouts, computers switchover timings, Display updates, Display Call-ups, poll time calculations etc.]

DRAWINGS:

Engineering drawings / documents –

This document shall cover the drawings / documents such as interconnection diagrams, supplied RTU cubicle typical layout and GA, RTU internal layout and interconnection drawings for each type of I/O cards, PDB internal layout, Internal layout of RTU cabinets.

Construction drawings / documents:-

Documents such as Mounting arrangement of each cabinet, cable schedule, termination & wiring diagrams, grounding schemes / diagrams has to be submitted by the vendor.

Power Consumption and Utilisations Report (PUCR)

Vendor shall furnish power consumption details with detailed break-up for each subsystem/equipments including inrush current and its duration during detailed engineering. This document will be submitted at the earliest so that required power availability can be ascertained by GAIL in time.

Factory Acceptance Test (FAT) Plans and Procedure Documents:

FAT document for RTU shall contain test sections to test all the aspects of SCADA System as covered in relevant Purchase Requisition (PR), FDS documents.

SCADA Vendor (YIL) also tests for compatibility with Centralised SCADA.

Site Acceptance Test (SAT) Plans and Procedure Documents

SAT document shall contain test sections to test all the aspects of testing of data for all IEDs and integrated with Centralised SCADA System, Test run & procedure documents has to be submitted.

Manuals

At least 30 days prior to the SAT, the proposed Operating and Maintenance Manuals and Final Drawings shall be submitted for review by the Owner.

Other Documentation

Bill of Material, Quality assurance plan, Billing procedure, Installation & Test procedure (which also includes the mounting arrangement of each cabinet), Site execution plan.

As-Built Manuals

The operating and maintenance manuals and drawings shall be updated with changes made to the equipment, configuration, and parameters or operating procedures during the installation and commissioning.

Final IO list along with cabling termination detail carried out between different panels by RTU vendor (in GAIL's format) has to be submitted along with the as-built

As-Built Operating and Maintenance Manuals shall be supplied prior to taking the Final Acceptance of the System.

22.1 RTU Vendor shall take care of project specific customizations for RTU system for meeting the project specific functionalities.

22.2 The review by OWNER'S/OWNER'S REPRESENTATIVE however does not absolve the RTU vendor of his responsibilities to satisfy' the requirements of contract document and install & commission the RTU system accordingly. RTU vendor is required to make necessary rectification in the RTU system to meet the requirements of the contract document at any stage of system implementation, without any implication of cost and schedule to the OWNER.

22.3 It is RTU vendor's responsibility to incorporate all the comments of the OWNER'S/OWNER'S REPRESENTATIVE in one revision itself. RTU vendor shall be responsible for incorporation of comments (comments not incorporated in the revised document without prior bringing to the notice of the OWNER'S/OWNER'S REPRESENTATIVE for acceptance) in the RTU system at any stage of the system implementation, without any implication of cost and schedule to the Owner.

22.4 RTU Vendor shall take care of the complete requirements of designing, generation and implementation of RTU displays for monitoring & control, RTU reports, RTU alarms/ events, RTU trending taking care of P&lDs and list of electrical parameters and covering the requirements outlined in this specification for RTU implementation.

22.5 The review code will be furnished by OWNER'S/OWNER'S REPRESENTATIVE only when the complete document is furnished by RTU vendor.

22.6 RTU vendor shall furnish the point wise response to OWNER'S/OWNER'S REPRESENTATIVE comments indicating the document section/clause/page no. reference where the same has been included in the revised document. The body of the document and corresponding pages will show the revision bars only at the places where the revision has been carried out. OWNER'S/OWNER'S REPRESENTATIVE will be required to check the revised document w.r.t. these changes only, while considering that rest of the document has remained unchanged.

23. TRAINING

Vendor shall provide training to technical, operator & maintenance personnel of the company in India. Company will bear the expenditure pertaining to air ticket, daily allowance, hotel expenditure and local conveyance for company's personnel for attending the training.

Training has to be provided at vendor's works having full training facilities for all the training specified in various clauses. Training documents contains all the details as specified have to be provided to all the trainee as per the schedule.

Training to be done at the integration centre where all the types of equipments supplied are simulated for practical training as defined elsewhere in the tender document. Each trainee to be given dedicated demo RTU system for hands on practice during training.

RTU vendor shall train 4 man-weeks for OWNER's RTU engineers on internals and maintenance of the supplied system. The training shall include the following:

a) System internals.
b) Operate & maintain the system
c) Configuration /programming of RTU for integration of I/Os, IEDs, integration with SCADA software
d) Generation & modification Point database
e) Programming RTU to built logic, make program to poll IEDS with propriety protocol etc.
f) Precaution and safety aspect for RTU.

RTU vendor to note that all programming languages, commands, display languages etc. system shall be in ENGLISH language only.

24 WARRANTY / EXTENDED WARRANTY

24.1 The system shall be guaranteed to give specified performance of 99.99% for a period of 24 months (two years) from the date of "provisional" acceptance of the system by the owner or 28 months from the actual delivery of material at site after FAT and issue of IC (whichever is earlier) as per the terms & condition of contract. This warranty shall survive inspection of goods and acceptance of the system.

24.2 Bidder shall quote **extended post warranty per month from** the date of actual expiry of main warranty (i.e. period of 24 months (two years) from the date of "provisional" acceptance of the system by the owner or 28 months from the actual delivery of material at site after FAT and issue of IC (whichever is earlier) as per the terms & conditions of contract. After 28 months Client / EIC ordered extended warranty in writing for additional period. The additional period will be decided at the time of order placement. Period for extension will be finalized by the client as per the requirements & accordingly payments will be made as per SOR rate.

Contractor's engineers/ technicians, capable of trouble shooting & looking after the health of the system during the warranty period, shall be made available all through the period of 24 months (two years) / extended period.

During the Warranty / Extended Warranty, the vendor shall use his own instrument, spares, man-hour, communication facilities, hardware, software, materials, etc. for the rectification of any problem.

24.3 In case of failure of any equipment, replacement is send immediately within 15 days. It is advice that Vendor should keep sufficient spare for warranty support in its stores (designated store to be informed during detailed engineering).

If the replacement is not send within specified time then penalty at the rate of Rs 5000/- per week has to be imposed. In case bidder still not responds then same may be deducted from the CPBG as per the terms and condition of the contract.

Also vendor to provide RTU firmware upgrades and configurator software upgrade free of cost to GAIL within warranty/extended warranty period.

24.4 System Warranty including all services and spares including consumables for operation and maintenance of the system.

24.5 **Technical Support Service**

Technical Support Services that extends coverage for GAIL after handover of the system. This includes 24 x 7 (24 hours x 7 days a week) on line support. GAIL shall utilize this service by intimating the bidder in case of any contingency and Vendor in turn provide telephonic support. Depending upon the severity of the issue, engineer shall be sent by vendor to the site. All the costs for this support are in the scope of vendor.

25 QA / QC REQUIREMENTS

The Bidder shall operate a Quality System meeting the requirements of the relevant part of ISO 9002.If bidder is not the OEM of RTU then he should follow QA/QC of OEM also.

Bidder shall provide documents such as plans, procedures, instructions, etc. for the accomplishment of all works covered in this specification to provide the required quality.

Specific adherence to the guidelines set down in ISO 9002 series documentation shall be detailed out by the bidder and shall be subject to review and approval by the Company.

Vendor shall submit the quality management system meeting the requirements of ISO 9001 – 2000 which he proposes to operate while executing the job.

The system documents shall cover Quality Plan for this job, procedures, work instructions, inspection and test plans (ITP) and test results reporting format to provide an approach for achieving the required quality job. The quality system shall be reviewed and approved by the company.

Owner reserves the right to undertake such audit as deemed necessary to assess the effectiveness of the Bidder's quality system.

26 CERTIFICATE FOR LOGISTICS SUPPORT

Vendor shall provide backup engineering, maintenance support and spare part supports for a period of ten (10 years) for the RTU being supplied .Logistic support certificates as per format attached with the bid document.

27 SUPPLY AND STORAGE OF EQUIPMENT

This shall include but not limited to supply and storage of equipment and all other items required for installation and commissioning of the network including the following:

- Transportation of equipment and all other components from locations of manufacturing to Site or Site store and then to locations of installation.
- Storage during transit & storage after installation till the handing over to owner.
- Statutory clearances including clearances of Customs, Excise, Octroi and others, as required for all the supplied items.

Bidder has to deliver the material at site after FAT and store at site till the readiness of the control room at respective locations. When the site is ready then shift the RTU at respective locations.

Bidder has to complete the work as per the schedule, if the site is not ready even after 6 months of the completion schedule (i.e. upto 22 months) as define in the contract then bidder may compensate the expenditure of store (as per the all inclusive rate **per month** available in the tender) till the readiness of the site. The payment will be made from seventh month (No payment upto six months from date of completion) onward from actual date of completion as per the certifications by EIC/ client. In this situation, after intimation from GAIL, the site work has to be completed within the time stipulated for site works as per tender.

28 SITE PREPARATION

This includes all electrical and civil works and site preparation activities as define above for installation and commissioning of the equipments.

ACCESSORIES / OTHER ASSOCIATED ITEMS

Supply & Installation of necessary equipment, cables trays, cables & accessories to meet the overall system requirements along Natural Gas Pipeline at respective sites, separate earthing & lighting protection of indoor equipment (not earth pit) at respective locations etc. Furniture as required for various systems, sub-systems, equipment etc shall be supplied by the Vendor.

System integration including requisite interfaces and accessories to realize the complete system shall be in bidder's scope.

Civil Trench inside the control room will be provide by client, however, the erection of foundation channel including support welding etc work as required as per the base frame of RTU shall be provided by the bidder.

The vendor shall extend the power from GAIL provided power point to the DCDB, to be installed in the equipment room using the armoured DC cable. For the same, the DCDB and armoured cable shall be supplied and installed by the vendor.

Any item of goods/services not specifically mentioned, but considered essential for completion of the work in all respects shall be deemed to be included in the scope of work of the successful Vendor. As the work has to be executed as a turnkey responsibility, any erection material required for supply & commissioning has to be provided as per the site requirements.

29 ANNEXURE :

ANNEXURE - I to ANNEXURE- XVI (Refer Index sheet)

****

ANNEXURE - I
TECHNICAL SPECIFICATION FOR RTU

Rev. : 1

Edition : 1

SPECIFICATION

FOR
REMOTE TELEMETRY UNITS

SPECIFICATION NO.: MEC/S/05/E5/099

ELECTRICAL & INSTRUMENTATION
(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092

AMENDMENT STATUS

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)
1	Additional reqmt added			27.09.10	VJ	PS

Table of Contents

1.0 GENERAL

2.0 RTU SUBSYSTEMS

2.1 DIGITAL INPUT

2.2 DIGITAL OUTPUTS

2.3 ANALOG INPUTS

2.4 ANALOG OUTPUTS

2.5 PULSE INPUT MODULE

3.0 COMMUNICATIONS

4.0 RTU FEATURES

5.0 INTERLOCKING LOGIC

6.0 DATABASE STORAGE AND RETRIEVAL

7.0 SERIAL LINK REQUIREMENT

8.0 PACKAGING:

9.0 DATA AND DRAWING DETAIL

10.0 RTU SPARE SUPPORT

1.0 GENERAL

The RTU's shall be 32 bit microprocessor based programmable units with both erasable RAM and ROM memory. Each of the RTUs shall have its own processor, memory, battery backed power supply unit & communication processors confirming to communication protocol like DNP 3, Ethernet etc and I/O cards complete in all respects. The RTUs shall have TCP/IP port and serial port for polling from Master Station & Emergency Master Station.

All RTU shall be modular and from the same model product line with identical capabilities. The RTU I/O Modules shall be interchangeable without any interruption. RTU shall be reliable, field proven and evolutionary state of the art.

The I/O cards shall not be combined for the functionalities i.e. each card shall dedicated modules for Analog input, Analog output, digital Input, Digital output etc. The RTU's shall be designed to function such that no single point of failure or the inadvertent leaving of a printed circuit board out of the RTU shall cause a control mal-operation or result in any false operation or continuous communication transmission.

The complete RTUs shall be supplied with all its components including the cabinets. The cabinets should be weather proof and suitable for non-air-conditioned room. The actual layout of RTU along with its internal wiring, mounting arrangement etc. shall be carried out in detailed engineering. Proper illumination shall be provided inside the RTU cabinet.

2.0 Environmental

The equipment selected will operate in the following conditions:

- Ambient Temperature 55 ° C
- Humidity 05-95% RH.
- Non air-conditioned environments

3.0 Power Supply

RTU shall operate at 24 V DC power supply. The power supply available will be 24 V DC or 230 V AC $\pm$ 10%, 50 Hz $\pm$ 3% as indicated in the Tender elsewhere. The Vendor shall select the power supply module accordingly and furnish the power consumption of equipment in format enclosed with tender.

4.0 RTU SUBSYSTEMS

4.1 The RTUs shall comprise the following subsystems**:**

- Central processor with system software.
- Analog input
- Digital (contact) input
- Digital (contact) output
- Analog Output
- 2 Ethernet port for polling for simultaneous polling from FEPs through DNP 3.0 (TCP/IP)
- Serial ports/Ethernet port to connect Portable Diagnostic Test Unit (PDT)

- Serial ports for connecting IEDs e.g. Flow computers, Gas chromatograph.
- Battery backed power supply (SMPS).
- Diagnostic tools (Online from MS/BM and off-line diagnostics)
- 2 Ethernet port for future polling of IEDs through TCP/IP
- Interposing Relays for Digital Output

The RTU's shall be configured such that interdependence of function is minimized and failure of any part of a RTU Module subsystem except the common logic subsystem shall not directly affect the integrity of the unit, as a whole.

The RTU should be able to store alarm/ events in case of communication failure till the time of communication restoration.

4.2 The RTU system software shall provide the overall management of the supervision, monitoring and control function within the RTU and also manage communications, comprehensive diagnostic facilities and RTU start up procedures. RTU shall be accessible from Master station for configuration and diagnostic same as from local.

4.3 The RTU shall be programmable and shall have facilities for developing logic for interface with the IEDs as and when required. To this effect, all necessary tools, softwares and documentation shall be part of supply of the RTUs within the scope of this document.

4.4 **Guide line for I/O points & RTU cards :**

a) The Digital Output should be configured for pulse duration. No separate program or logic will be acceptable at RTU end. On RTU restart/ power failure, RTU shall not reset the output circuit, shall not generate false control signal and cancel all pending control signal.

b) AI, DI cards of the RTU should have minimum 16 IO points. The AO and serial card should have minimum 4 IO points / port. The DO card should have minimum 8 points/ ports.

c) All the field / IED Parameters should be configurable at the RTU end on Modbus ascii and Binary protocol.

d) Each RTU should have 25% spare I/O points and additional 25% spare slots of total installed serial and I/O cards slots. The spare slots to be covered with appropriate enclosure to avoid any dust particle entering the RTU.

e) RTU should be internally wired for all the cards available IO points in the RTU.

f) RTU vendor should provide the final indexing of all I/O points for each RTU to enable SCADA vendor to configure the SCADA database.

g) RTU vendor to provide Field I/O details (list of I/O points along with engineering units, range, alarm limits, status corresponding to open/close contacts, indexing details in the RTU etc.) for configuring in SCADA as per GAIL standard I/O list format to be provided by GAIL.

h) RTU should have calculation features in it for defining RTU resident calculation points.

i) The RTU should have diagnostic feature for hardwired IOs, DNP and IED communication (Modbus) from remote as well as from local.

5.0 DIGITAL INPUTS

Typical specification of Digital Input Modules to be supplied is as given below:

Input Type	:	Min. 16 nos. of Potential free contacts (2 wire isolated)
Contact Wetting	:	2-4 mA per input at 24V DC
Resistance recognized	:	Not exceeding 1 Kilo Ohms as a closed contact
Resistance recognized	:	Not less than 50 Kilo Ohms as an open contact
Isolation	:	Using optocouplers
Insulation Resistance	:	20 M ohms at 500 V Dc inputs
Debounce circuitry	:	10 m/sec
Indicators	:	Loop & State LEDs for each DI point
Voltage withstand Capacity	:	1.5 KV RMS
No/NC contacts	:	mixing of NO/NC contacts in the same card.

6.0 DIGITAL OUTPUTS

Typical specification of Digital Output Modules to be supplied is as given below:

Output Type	:	Min. 08 nos. of relay contacts
Indicators	:	LED indication for each DO point
Relay Type	:	Miniature power relay
Contact arrangement	:	1 NO + 1 NC relay contacts configuration to be provided up to the RTU terminal block
Contact Rating	:	Potential free contact rating of output interposing relay for each DO point (Contact rating 48 V DC, 2A; 230V AC, 5A)
(SCADA vendor to provide interposing relays for each digital output point including spare point)		
Isolation	:	2KV RMS Contacts to Logic
DO command activation	:	Configurable Pulse duration (min 2 sec)
Security	:	Output contacts shall be monitored via Opto-isolators and must be short circuit proof and protected by suitable mechanism like fuse with suitable fuse blow indication provided.

7.0 ANALOG INPUTS

Typical specification of Analog Input Modules to be supplied is as given below:

Input Type	:	Min 16 isolated, Current Inputs
Ranges	:	4 - 20 mA, 0-5 V
Input impedance	:	Not less then 100 K for Voltage input Not more then 0.4 K for current Input
Multiplexer	:	By vendor
ADC type	:	12 bit binary, (exclusive of sign bit)
Series Mode Rejection	:	Greater than 30 db at 50 Hz
Common Mode rejection	:	Greater than 100 db at 50 Hz

Roll over error	:	1 bit
Temperature coefficient	:	0.005% per degree C
Accuracy	:	± 0.1% of range including drop in resistor

8.0 ANALOG OUTPUTS

Specifications of Analog Output modules to be supplied is as given below:

Output type	:	Min.4 Completely Isolated current (4-20 mA) outputs
DAC Type	:	12 bit binary (exclusive of sign bit)
DAC span	:	10 V or 5 V
Output Range	:	4-20 mA DC
Isolation	:	Each output shall be isolated from logic and others to 500 Volts
Loading	:	1K ohm for Current outputs
Differential Linearity	:	½ L.S.B.
Accuracy	:	± 0.1% of range
Temperature coefficient	:	0.01% per degree C of FSD
Update	:	within 10 msec.
Retentivity	:	Set-point value to be held by AO card till update by new set-point value from MS / EMS

9.0 COMMUNICATIONS

The RTU shall support both internal and external communications functions.

The communication network internal to the RTU shall be designed and implemented in such a way that the passing of data and commands between modules shall not be prevented by the failure of any module not directly involved in the communication exchange. In addition the internal network shall not become overloaded under the heaviest traffic possible in the RTU's ultimate expansion configuration.

Each RTUs will be polled from both the communication ports of RTU simultaneously from SCADA FEP Servers (to be kept at two end of the pipeline section) Accordingly RTU to have buffer availability for replying to both the FEP Servers simultaneously in real-time.

The SCADA FEP Servers shall initiate communications with a selected RTU by IP addressing function. Each RTU shall recognize its own unique address and shall have the capability of being assigned any address within a range of possible addresses. It shall be possible to address all or selected number of RTUs from the SCADA FEP Servers in order that global or broadcast message may be sent.

The LED indication shall be provided in the RTU to check the health of RTU communication.

The RTU shall support both DNP 3.00 (TCP/IP) protocol for communicating with SCADA system FEP Servers. This will be standard Protocol for all the station communications.

The RTU shall be polled through Ethernet port from MS/EMS/FEP.

10.0 Guide line for Communication :

a) RTU shall have dual Ethernet ports (configurable independently) for TCP/IP communication with FEP on multi-dropped environment.
b) The RTU should support DNP 3.0 protocols for communication with FEP.
c) Serial ports for communicating with IEDs shall be in a separate card and should not be in the same card having Ethernet communication ports for SCADA communication.
d) The RTU communication card shall be user configurable for various communication settings (e.g. hardware controls, Pre-Transmission Mark settings etc)
e) Serial ports available at serial card should be independently and individually configurable at all respect.
f) It shall be possible to do configure / write IED interface through modbus protocol in RTU for which necessary software tools shall be supplied. RTU shall support all the fucntion code of modbus protocol to interface IEDs.
g) For communication with IEDs through serial and Ethernet ports, the RTU shall support 16-bit, 32-bit, signed, unsigned, integer and floating point data type of Modbus protocol.
h) The hardwired cabling from RTU to Telemetry Interface Cabinet (TIC) panel, the cables should have pair number marked on each pair. For analog signal, individual & overall shielded cables are to be used.
i) Communication from RTU to Telecom panel for SCADA, CAT 6 cable shall be used.

11.0 RTU FEATURES

11.1 The RTU sub-system shall support the following:

a) Scanning of Input and Output
b) Fast scanning of selected I/O's points.
c) Field input initiated discrete control action.
d) Discrete control action corresponding to Remote Control Command reception.
e) Operator initiated discrete control action with check before execute and time out feature.
f) Operator initiated discrete control action with sequencing and interlocking.
g) Derivation of calculated digital points based on logical functions AND,OR,NOT etc from Digital and Analog input points.
h) Derivation of calculated analog points based on arithmetic functions +, -, /, *, sq, root etc. and driving external hardware. Calculation shall be performed in RTU in engineering units with 16 bit or higher floating point accuracy in case engineering conversion is being done at RTU level. (Calculations shall be performed in the SCADA server in case engineering conversion is being implemented in the SCADA server.)
i) Deviation of counter values using Integration of hardware and software generated analog points
j) IED (Flow computers, Gas Chromatographs), CP Panel, Solar system, UPS panel interfacing through RS232/ RS 485 ports for serial data.
k) Rate of change of alarm
l) RTU resident accumulator points driven by analog points.
m) Remote configurations of RTU from MS/EMS/FEP through PDT/ PC
n) Compatible with IP based telecom system
o) RTU should have event logging and buffering feature. In case of communication loss, RTU shall store the events in the buffer and transmit to Master Station on restoration of link.
p) RTU should have calculation features in it for defining RTU resident calculation points.
q) RTU should have surge/lightening protection for power supply

r) Mandatory spares shall include at least 10 % or as define in the tender all types of installed cards / convertor / Power supply / terminating boards etc.

s) Test jig with configuration of all I/O points to be supplied, installed with required power and communication cabling and made online with SCADA system.

t) RTU shall have provision to configure following settings minimuma)

IP Address Settings

IP Address for LAN A : RTU IP for LAN A & 4 IP address for Master SCADA with 2 unique domain

IP Address for LAN B : RTU IP for LAN B and 4 IP address for Master SCADA with 2 unique Domain

Source Address : 0 (DNP Master SCADA Address)

11.2 Automatic time synchronization of Remote Telemetry Units shall be implemented from MS / EMS / from various FEP Servers along the pipeline with a resolution of 100 msec.

11.3 The RTUs shall have a self diagnostic feature and software watchdog timer devices to monitor & report the healthiness of CPU, memory, power supply, comm. interfaces and Input/Output modules at the local level. Further the RTUs shall support remote diagnostics from MS / EMS / various stations so that all these status shall be transmitted to MS / EMS and displayed in the RTU status graphic.

11.3.1 Analog input card and Analog output card shall be self calibrating type and event shall be sent to MS /EMS for out of calibration. Analog input card shall generate an event, if it is out of calibration, which shall be sent to MS/ EMS. Further if Analog output card is not self-calibrating type then all Analog outputs shall be wired back as along inputs and calculations performed on each channel to detect AO card out of calibration. This provision should be available in the SCADA system, however separate card (AO / DO) is not required. This out of calibration shall be available as part of RTU status graphics along with set point value displayed in the graphics, next to the corresponding controller symbol.

11.4 It shall scan and acquire parameters from process as per programmed scan cycles.

11.5 RTUs shall be intelligent in support of the following:

a) It shall process the analog data for high-low limit violations as per stored limit tables and communicate the same to MS along with time stamping.

b) Linear conversion to engineering units and input filtering, in case engineering unit conversion is being done at RTU level [conversion of raw data to normalized values (e.g. 0 to 1.0) for communication shall also be acceptable].

c) To support remote reconfiguration and downloading of parameters i.e. addition, deletion, modification and reassignment with different range, limits etc. from workstations to avoid local engineering at RTU level. The following requirements of RTU configuration form MS / EMS shall be fulfilled:

(i) The remote configuration wrt following parameters for the points defined in the RTUs shall be remotely done from active SCADA Server at FEP Servers / MS / EMS, in case the

features of Alarm generation, association of the alarm priority and engineering unit conversion are implemented at the RTU level.

- Analog alarm limits
- Analog scaling factor for engineering unit conversion
- Threshold value
- Filter time constant etc.

These shall be automatically updated to the standby SCADA Server also.

(ii) RTU vender shall include in scope of supply at MS / EMS/ various stations, PDT configuration unit (Monitor & Keyboard, hardware & software with cables & connectors) to create configuration file involving definition of:

- I/O modules attached to the RTUs
- Type of each I/O modules and time stamping requirements for points in each module.
- The mapping of RTUs data base to the DNP Protocol address space
- Software logic in RTUs
- Physical and software interfaces connected to the RTUs

(iii) The configuration file shall be able to be transferred online from MS / EMS / various stations using the existing data channels to the corresponding RTU.

(d) Time stamping of all exception reports.

[However, the SCADA vendor has the option to implement the features of Alarm generation, association of the alarm priority and engineering unit conversion at the RTU level or SCADA server level].

11.6 RTU shall comply the following:

a) RTU shall be capable of updating process parameters data and configuration data in its own built-in memory. Time stamping of all field values at RTU end shall be required. In the event of failure or break of communication link, the RTU shall continue to scan all parameters and update its database. RTU shall retain in its database the complete analog and digital information of the field till it is completely and correctly read by MS / EMS / various stations in order to take care of no loss of data in case of failure of MS / EMS / various stations. The RTU shall scan the field and the memory buffer is to be sized to store all the changing data (i.e. new exception report for the data every poll time) and MS/EMS/FEP/various stations receive the same without any loss of data and alarms in the SCADA system to take care of channels SCADA server switchover times.

b) Further to take care of long term communication outage with MS/EMS/FEP the RTUs shall be designated to also scan the field and store in the memory up to 1000 field's exception reports during the period of communication outage for retrieval by MS subsequently.

c) The RTU system shall have the facility to attach to each digital event signal a time tag generated by the RTU local clock to enable the occurrence to be recorded and transferred with the resolution of 100 ms.

11.7 It shall be possible to have highest priority of alarms, in order for the same to be sent to MS/EMS/FEP. The SCADA vendor has the option to implement the feature of association of the alarm priority at the RTU level or SCADA server level.

11.8 It shall provide 'Check before Execute' feature before execution of command.

11.9 Every control associated with the RTU shall report the status of the point after control execution. In case the status has not changed within fixed specified time it shall report to MS / EMS/ various stations for not having executed the control.

11.10 RTU shall not generate any false control signal due to power supply on-off conditions.

11.11 RTU shall support communication protocol supporting report by exception to prevent unnecessary data communication when the data is not changing.

11.12 It shall provide error detection and control feature for data communication with MS/EMS/FEP to ensure data integrity.

11.13 It shall have feature of connecting a pluggable Programmable Diagnostic Test unit (PDT) with keyboard & monitors diagnostic and programming aid to trouble shoot and configuration tool for RTU and I/O boards. It shall be possible to exercise all the functions of the RTU without disconnecting the RTU from process.

11.14 RTU shall have provision for applying filtering on the input signals and scaling for engineering units conversion.

11.15 From MS/EMS/FEP it shall be possible to off-scan complete RTU individually in addition to off-scan RTU points. In case of failure of complete RTU or off-scan of complete RTU only one alarm shall be generated and the RTU along & digital points shown in various graphics and printed in reports shall correspondingly have data integrity qualifier flag.

11.16 The RTU shall be able to store the configuration data and the process database upon power failure for at least one month. Upon restoration on the power, RTU shall resume the normal operation automatically.

11.17 The failed RTU once put online shall initiate service requirement to MS/EMS/FEP for re-initialization.

11.18 RTU shall operate power supply (230 V AC or 24 V DC as define elsewhere) as per power availability at site. Separate on/off power supply switch and fuse shall be supplied with each RTU. SCADA Vendor shall indicate power consumption for all the RTUs. Adequate isolation of input, output and power supply circuits shall be provided along with over voltage and short circuit protection.

Wherever 230V AC supply is provided for RTU, SCADA vendor shall carry out necessary conversion to covert the AC voltages to 24V DC for supply to field instrumentations and to RTU. The power to the field instrumentations is to be provided through barriers and all the digital output has to be driven through 3-5 A interposing relays. The necessary converter to covert the AC voltages to 24V DC, the barriers and the imposing relays shall form the integral part of the RTU.

Terminations for connections of power supply should be of standard industrial type.

11.19 All the field instrument connections for RTUs shall be terminated in the TIP (Telemetry interface panel). The I/O point wires shall not be directly terminated on the RTU I/O boards. Terminal blocks/panels are to be provided in the RTU cabinet. I/O termination blocks shall have both male and female portions so that to isolate the field wiring at RTU level, male/female termination block attached to be field wiring can be pulled out instead of removing the wiring. Printed tube type Cross ferruling shall be done.

11.20 The electronics in the RTU cabinet shall consist of plug-in PCB's or units with Gold plated edge connectors that utilize a wiping action for connection for PCB's to the back frame wiring. SCADA Vender shall detail the shelf and inter-shelf wiring and the termination of the wiring harness between the RTU and the terminal block area. Easy access cabinet wiring, for maintenance purposes is essential. The PCBs and RTU components shall be designed for high temp rating and low power consumption so that air exchange with the ambient environment will not be required.

11.21 The RTU shall be Immune to radio frequency interference generated by any nearby source meeting the latest international standards in this regard (MIL, VDE etc.)

11.22 The RTU equipment shall function continuously without requiring any preventive maintenance.

11.23 RTUs shall be multidropped on a pair of communication channels. Each RTUs will be polled from both the communication ports of RTU simultaneously from SCADA FEP Servers (to be kept at two end of the pipeline section). RTU should reply to both the FEP Servers simultaneously in realtime. without any loss of data & operation. System shall provide status on the availability of each of the channels.

11.24 It shall be possible to output any AI (Including serial data from IEDs) & DI point value available in real time database at MS / EMS, as AO (Including serial data from IEDs) & DO to any RTU respectively. The relay contact configuration shall be provided up to the RTU terminal block. The DO command contact closure duration shall be configurable. It shall be possible to configure DO contact duration open or close for a long duration as per the DI status. This provision should be available in the SCADA system, however separate card (AO / DO) is not required.

Within the scope of this document, SCADA vender shall down load Gas Chromatograph value to those Flow Computers, in those locations where Gas Chromatograph is not available, through the same serial link which is used for reading the Flow Computer values. Source Gas Chromatograph and target Flow Computers will be finalized during detail engineering.

11.25 Non availability of any one of the two communication channels should not hamper the functioning of the other RTUs multidropped on the pair of channels.

11.26 RTU vender to ensure that the open/close status of valves (open state first wired and thereafter close state) be wired consecutively in the RTUs.

Interlocking Logic

The means to minimize the risk of incorrect operation or incorrect sequence of operations can be included within the RTU as a logical interlocking function.

All the data shall be available in the engineering units in the RTU database. The RTU vendor has the option to implement the feature of engineering unit conversion at the RTU level.

11.27 It shall have feature of connecting a pluggable Programmable Diagnostic Test unit (PDT) with keyboard & monitors diagnostic and programming aid to trouble shoot and configuration tool for RTU and I/O boards. It shall be possible to exercise all the functions of the RTU without disconnecting the RTU from process.

11.28 RTU Vendor shall detail the shelf and inter-shelf wiring and the termination of the wiring harness between the RTU, the terminal block area and the field instrumentation. Easy access to cabinet wiring, for maintenance purposes is essential. The RTU components shall be designed for high temperature rating and low power consumption so that air exchange with the ambient environment will not be required.

11.29 Identification labels for RTUs, RTU card files, power distribution boards, terminations etc complete in all respects properly correlating with the drawings is to be ensured by the RTU vendor.

11.30 **SCAN RATES**

The local scan rate for the individual I/O modules shall be such that the time-tagging resolution and system performance requirements are achieved.

Vendor to provide minimum & maximum SCAN time

The consideration of scan times shall include the acquisition of data, processing and updating of the RTU database. The overall RTU local scan shall be defined as the time required to acquire field data and update the RTU database and the same shall be much faster than RTU poll time by MS / EMS. It is expected that scan rate shall not exceed 100 msec for direct I/Os

11.31 DIGITAL OUTPUT (CONTACT) SUBSYSTEM

The contact output subsystem shall provide momentary closure of potential free contact relay output for the operation of valves. The subsystem shall fully support the functional requirement of control

The relay contact configuration shall be provided up to the RTU terminal block.

The DO command contact closure duration shall be configurable. It shall be possible to configure DO contact duration open or close for a long duration and all contacts shall be voltage free.

It shall not be possible for the RTU to energize an output that has not been selected for control.

A RTU restart, following an RTU power failure, shall not reset the output circuits, shall not generate false control signal and shall cancel any pending control selection.

Set point controls:

All analog output control functions shall utilize the select-check-operate control sequence associated with set point control.

11.32 Each I/O shall be protected against the reverse polarity of the power voltage to I/O.

11.33 **RTU Panels**

RTU Panels shall be free standing and conform to NEMA-4 (IP55) requirement. The panels shall have lockable front and rear doors and bottom cable entry and provided with gasket and fitting to keep out moisture, salt, dust, greases and corrosives. The panel shall be naturally cooled.

All doors, drawers, trays and other weight supporting parts shall be fabricated of metal and adequately reinforced to limit vibrations. All components and devices inside the panel shall be well highly and the panel shall have a tidy look.

The Vendor shall furnish details of the shelf and inter-shelf wiring and the termination of the wiring harness between the RTU and the terminal block area, the connections from PCB's to back frame wiring shall preferably be with gold plated edge connectors which utilize a wiping action. Easy access to cabinet wiring for maintenance purpose is essential. The I/O point wires shall not be terminated directly on the I/O boards. Termination panel is to be provided for this.

The RTU equipment cabinet (Rittal or equivalent) to be supplied shall be constructed to allow free airflow to dissipate heat generated. Construction shall be such that ventilation grills will not be obstructed when equipment is mounted in its installed position. In order to effectively remove dissipated heat from the cabinets, vent louvers backed by wire fly screen shall be provided. RTU vendor shall calculate the heat dissipation and where the calculations prove the necessity, then air flow ventilation shall be assisted by integral low

power silent running air extraction fans and same shall be included in RTU vendor's scope. In let ventilation grills shall be filled with dust filters.

The Vendor shall guarantee satisfactory functioning of the system hardware mounted in the panels even in the event of failure of air-conditioning unit.

Each panel shall have provision for fully wired 25% (of IO requirement mentioned in Annexure II) spare additional I/O terminals for each type of I/Os (AI, DI, DO, AO) to take care of any additions in future. All the I/Os present in each cards installed in the RTUs (including spares) has to be wired till termination board. For DO card provision of relay has to be made for all the I/Os available in the DO cards installed.

Hardware mounted and wired panels of all systems included in the scope of the Vendor shall be subjected to burn-in operation for minimum 15 days before dispatch to site.

A typical panel Rack drawing is enclosed with this document for reference purpose. Vendor has to select the Rack as per dimension refer in enclosed drawing.

The RTU's cabinet shall be made of CRCA sheet enclosures frame minimum thickness shall be 1.5 mm and the cabinet size 2000 mm height x 800 mm width and 800 mm depth and 100 mm base frame. Gland plate thickness shall be 3.0 mm.
Vendor shall supply necessary hardware's like DI, DO ,A1 and AO cards, complete with interning wiring upto the terminal blocks including spares I/Os.

The RTU cabinet shall be provided with 24V dc Power supply unit.

Non UPS power supply for Cooling fans, panel door switches, space heater, maintenance socket and Tube lights front & rear end.

Finish

i. All frame and steel work of the RTU cabinets shall be degreased, then phosphate treated or coated with primer, followed by at least two undercoats
ii. All the RTU cabinets shall have 'Nameplates' correlating with the type and location qf the cabinet.

11.34 Connection to Marshalling/ Instrument Control Panel/ Telecommunication System

All the instruments connections for RTU's shall be terminated in the Marshalling rack/ Control Cabinets (TIC panel) / Instrumentation panel to be supplied by other. The vendor shall include in the offer all necessary cables, materials and services required to install the RTU's and interconnect the I/O's with the Marshalling rack/ Inst Control Cabinet/ interface cabinets and RTU's along with interfacing with telecommunication system.

a) The hardwired cabling of from RTU to Telemetry Interface cabinet (TIC) panel, the cables should have pair number marked on each pair. For analog signal, individual & overall shielded cables are to be used.
b) Communication from RTU to Telecom panel for SCADA , CAT 6 cable shall be used.
c) RTU vendor should provide the final indexing of all I/O points for each RTU to enable SCADA vendor to configure the SCADA database.

d) RTU vendor to provide Field I/O details (list of I/O points along with engineering units, range ,alarm limits, status corresponding to open/close contacts, indexing details in the RTU etc.) for configuring in SCADA as per GAIL standard I/O list format to be provided by GAIL.

11.35 SERIAL LINK REQUIREMENT

u) The RTU shall be equipped with the RS 232 ports & RS 485 ports for polling the IEDs as specified in the document elsewhere. Additionally one more RS 232C or TCP/IP port shall be provided for connecting PDT for configuration of the RTU.

v) RTU vendor shall develop, configure and establish the communication for reading / writing of data from / to the flow computers / CP Panel / Gas Chromatograph or other IEDs. RTU vendor to configure RTUs for writing of GC data installed in one terminal(and connected one RTU) to flow-computers kept at other terminal(and connected to a different RTU) along the same pipeline. The client shall furnish to RTU vendor the make & model no., protocol details of these IEDs during detailed engineering or prior to FAT. RTU vendor shall simulate the above devices using protocol analyzers / PC /other means to demonstrate during FAT.

w) RTU vendor shall provide all the software tools and programs (source code) used to interface RTUs with Flow computer/ PLCs/ any other IEDs. It shall be possible for client to integrate other IEDs with the RTU in future. To achieve the same the RTUs shall have provision for integrating IEDs and all necessary software, compilers, tools etc. shall be supplied by the SCADA vendor. The alarms for power supply/ serial link failure/ flow computer & other IEDs malfunction through serial link shall be implemented. The integration of IED's (of any protocol not just modbus) with the RTUs shall be totally end user configurable.

x) The alarms for power supply / serial link failure / flow computer, CP panel & gas chromatograph malfunction through serial link shall be implemented.

y) The RTU memory sizing sizing shall be adequate for required nos. (as application) of flow computers / gas chromatographs serially connected with the RTU.

z) The Flow computer / Gas Chromatograph data shall be scanned by the RTU much faster than RTU poll time by MS / EMS.

aa) All the RTU shall be user programmable for interfacing with any kind of IEDs FC /GC /CP panel / Solar panel /UPS panel / PLC etc.

11.36 Input/Output Points and serial ports for polling IEDs:

The RTU vendor shall supply the RTUs equipped with I/O cards, IP port & serial ports (for IED interfacing) as per the I/O count and serial ports requirement define elsewhere. The RTUs shall be user programmable for interfacings with any kind of IED

11.36 **Aspects related to RTU configuration and diagnostics**

One licensed RTU configuration software (along with software CD) loaded on PDT shall be provided for every 10 RTUs/ 300 KM trunk pipeline in general or otherwise as indicated in the respective scope of work

RTU configurator software licenses shall be preferred in software (software key) form in instead of hardware (dongle). The PDT along with RTU configurator software shall be handed over to client before start of RTU commissioning activities and are not to be used by RTU vendor for commissioning activities.

bb) RTU configurator / diagnostic software shall have the following provision:

a. DNP index of all I/O along with hardware details and present value in single table/window.

b. All RTU cards, serial ports and communications channels health points are to be configured in RTU and DNP index of same are to be reflected in I/O list and all serial ports should be independently configurable.

c. Error detection/control feature to ensure data integrity.

cc) RTU should have the utility for configuration and diagnostics through remote and local.

dd) RTU should have diagnostic provision without uploading / downloading RTU configuration to PC/laptop.

ee) The RTU should have diagnostic feature for hardwired IOs, DNP/ DNP and IED communication.

ff) It should be possible to reload the RTU configurator software by GAIL engineers in case of any OS related problem or PDT failure.

gg) RTU should be completely configured for all the points available in the RTU irrespective of field termination.

hh) The RTU should be able to provide I/O card and serial port level health points to SCADA.

11.37 **Portable RTU Configuration and Diagnostic Test Unit**

RTU shall have feature of connecting a pluggable Programmable configuration and maintenance terminal along with all hardware and software necessary to interface to the RTU. This unit will function as a diagnostic and programming aid to trouble shoot and configure RTU and input/output boards. It shall be possible to exercise all the functions of RTU's without disconnecting the RTU from process. This unit shall be a note book PC with proper enclosure with key board and VDU. It shall operate on integral rechargeable battery which shall be able to supply power for a minimum of 12 hours before recharge.

The PDT along with Servers at FEP Locations / MS to be installed with licensed RTU configurator software along with all the cables & connectors required for configuration of

RTU. Also any additional software required for programming RTUs for dialup operation/ making logics etc needs to be provided by the vendor.

The PDT as diagnostic aid to RTU shall be a notebook (laptop) with proper enclosure and shall operate on integral battery which shall be rechargeable type. The battery shall be able to supply power as a minimum for 12 hours before requiring recharging operation. Also the PDT shall operate on 230 V AC power supply. Vendor shall provide all the necessary converter/adaptor along with PDT.

11.38 **PACKAGING:**

The RTU shall be packaged to withstand rough handling during ocean shipment and in-land journey. It shall be vendor's responsibility to make good any deterioration that occurs during shipment. Sling points shall be clearly indicated on crates.

11.39 **DATA AND DRAWING DETAIL**

Vendor shall furnish all the documents as per “Vendor Data Requirements” enclosed with Material Requisition/ Job Specifications. All the other documents as per Technical specification and the documents required for better understanding and execution of the job to be supplied by the Vendor.

A certificate from statutory authorities confirming suitability of design / construction of all electrical and electronic items for use in hazardous area classification has to be furnished.

11.40 **RTU SPARE SUPPORT**

Vendor to provide a certificate to client from OEM of RTU for RTU spare support for 10 years from completion of warranty.

11.41 RTU shall support compete DNP3.0 protocol with minimum object and variation as per following:

DNP 3 Objects : 30,32,01,02,03,04,40,41,42,43,10,11,13,80 and (object 12 & variation 01).

11.43 RTU shall support Report by exception and On demand scan polling.

11.44 Annexure - I

Enclosed.

ANNEXURE-1

TECHNICAL SCHEDULE TO BE FILLED BY THE TENDERER

The Vendor shall fill the following technical particulars and submit the same with the offer for selected Remote Telemetry Unit.

Item	Description	Particulars
	GENERAL	
1.	Make	
2.	Model no.	
3.	Degree of protection (IP No.)	
4.	Operating temperature range (degree centigrade)	
5.	Operating relative humidity range %	
6.	Maximum number of I/O modules per subrack Main subrack Extension subrack	
7.	Maximum number of communication modules per subrack	
8.	Selectable communication speed range	
09.	Resolution of time tagging	
10.	High/low limit checking yes/no	
11.	Whether RTU supports self-checkback-execute and time out feature yes/no	
12.	Interfacing with flow computers of different makes (Instromet/Spectra Tek, etc.) yes/no	
13.	Remote configuration and downloading of parameters from Master Station supported yes/no	
14.	Self diagnostic of RTU and reporting it to Master Station yes/no	
15.	Number of serial ports supported in addition to redundant communication links with Master Station (minimum 4 nos.)	
16.	Whether RTU supports connection of portable maintenance diagnostic test unit yes/no	
17.	Whether hardware for 25 % spare installed I/O's for RTU included yes/no	
18.	MTBF for a fully equipped RTU h	
19.	Equipment availability %	
20.	MTTR for a fully equipped RTU h	
21.	Power requirement for a fully equipped RTU W	
22.	Maximum number of I/O modules per RTU (separately for each type to be given)	
23.	Spare capacity for each type of I/O	

Item	Description	Particulars
24.	Rack dimensions	
25.	**Main Processing Module** Module designation	
26.	Microprocessor type	
27.	Word length	
28.	Basic clocking rate	
29.	Engineering unit conversion yes/no	
30.	Arithmatic processor facility with floating point capability yes/no	
31.	Programe location (i.e. EPROM,RAM)	
32.	EPROM k bytes	
33.	RAM k bytes	
34.	RAM battery back up for one month yes/no	
35.	Type of data bus available for communication among the I/O modules (serial/parallel)	
36.	MTBF h	
37.	Equipment availability %	
	Response Times	
38.	Time taken to access and display information requested by the user from the Master Station	
39.	Time taken to write one modified entry to the data base from Master Station	
40.	Time taken to write one modified entry to the data base from RTU maintenance facility	
41.	Time taken to validate a complete database following an instruction from the Master Station	
	Compliance with CCITT recommendations	
42	Physical interface	

Item	Description	Particulars
	ANALOG INPUT MODULE	
1.	Module designation	
2.	Microcontroller/microprocessor type	
3.	No. of inputs per module	
4.	Type of ADC	
5.	Scanning resolution bits	
6.	Whether AI module of self calibrating type and event reporting to Master Station if out of calibration yes/no	
7.	Accuracy %	
8.	Conversion time ms	
9.	Type of Analog multiplexer	
10.	Method of isolation	

11.	Surge withstand capability (as per IEEE Standards)	
12.	MTBF h	
13.	Equipment availability %	
14.	Power requirement W	
15.	Signal support: 4-20 mA and 0-5 V(Yes/No)	
	DIGITAL INPUT MODULE	
15.	Module designation	
16.	Microcontroller/microprocessor type	
17.	No. of inputs per module	
18.	Is input module type configurable as a) Status and alarms b) Sequence of events c) Parallel input d) Pulse accumulator e) Any combination of these	
19.	Contact bounce protection yes/no	
20.	Optical isolation yes/no	
21.	Scan time ms	
22.	Noise rejection yes/no	
23.	Surge withstand capability (as per IEEE standard)	
24.	MTBF h	
25.	Equipment availability %	
26.	Power requirement W	

	DIGITAL OUTPUT MODULE	
27.	Module designation	
28.	Microcontroller/microprocessor type	
29.	No. of outputs per module	
30.	Maximum output current mA	
31.	Maximum switched output voltage V	
32.	MTBF h	
33.	Equipment availability %	
34.	Power requirement W	
	ANALOG OUTPUT MODULE	
35.	Module designation	
36.	Microcontroller/microprocessor type	
37.	No. of outputs per module Max. no. of voltage outputs Max. no. of current outputs	
38.	Type of output interface (DAC)	
39.	DAC resolution bits	

40.	Overall accuracy	
41.	Type of isolation	
42.	Whether module of self calibrating type and event reporting to Master Station if out of calibration yes/no	
43.	MTBF h	
44.	Equipment availability %	
45.	Power requirement W	
	COMMUNICATION MODULE	
46.	Module designation	
47.	Microcontroller/microprocessor type	
48.	No. of communication channels	
49.	Type of communications interfaces supported	
50.	Designation of communication protocol	
51.	Type of protection	
52.	Type of isolation	
53.	MTBF h	
54.	Equipment availability %	
55.	Power requirement W	
56.	The standards to which modem conforms to	

	POWER SUPPLY MODULE	
57.	Module designation	
58.	Nominal input voltage V	
59.	Operating voltage range %	
60.	Output voltage range V	
61.	Input voltage protection kV	
62.	Output voltage protection kV	
63.	MTBF h	
64.	Equipment availability %	
65.	Power requirement for a fully equipped RTU W	

ANNEXURE – II

I/O COUNT & POWER SUPPLY DETAILS FOR NEW RTUS

Sl. No.	RTU No.	Station	AI			DI			DO			AO			Serial Ports
			AI*	AI# (EL+CP)	TOTAL AI	DI*	DI# (EL+ CP)	TOTAL DI	DO*	DO# (EL+CP)	TOTAL DO	AO*	AO# (EL+CP)	TOTAL AO	(NOTE-6 & NOTE-7)
1	RTU-DT – IPS-1**	Despatch Terminal at IPS-1	13	0+06	19	14	0+08	22	04	0+03	07	01	00	01	07
2	RTU-SV-1**	30” SV-1 (CH-17Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
3	RTU-SV-2	30” SV-2 (CH-32.982 Km)	05	14+0	19	04	17+0	21	02	3+0	05	00	00	00	03
4	RTU-SV-3**	30” SV-3 (CH-45.506Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
5	RTU-SV-4	30” SV-4 (CH-63.364Km)	05	14+0	19	04	17+0	21	02	3+0	05	00	00	00	03
6	RTU-SV-5**	30” SV-5 (CH-76.774Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
7	RTU-IPS-1** (NOTE-8)	IPS-1 (CH-90.615Km)	26	14+6	46	38	17+8	63	12	3+3	18	02	00	02	16
8	RTU-SV-6**	24” SV-6 (CH-108.545Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
9	RTU-SV-7	24” SV-7 (CH-123.730Km)	05	14+0	19	04	17+0	21	02	3+0	05	00	00	00	03
10	RTU-SV-8**	24” SV-8 (CH-138.704Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
11	RTU-SV-9**	24” SV-9 (CH-157.001Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
12	RTU-SV-10	24” SV-10 (CH-173.080Km)	05	14+0	19	04	17+0	21	02	3+0	05	00	00	00	03
13	RTU-IPS-2**	IPS-2 (CH-188.80Km)	02	14+6	22	16	17+8	41	04	3+3	10	00	00	00	06
14	RTU-SV-11**	24” SV-11 (CH-212.80Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
15	RTU-SV-12**	24” SV-12 (CH-236.80Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04

16	RTU-SV-13**	24" SV-13 (CH-260.80Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
17	RTU-SV-14**	24" SV-14 (CH-284.80Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
18	RTU-IPS-3**	IPS-3 (CH-300.8Km)	02	14+6	22	20	17+8	45	06	3+3	12	00	00	00	06
19	RTU-SV-15**	24" SV-15 (CH-316.80Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
20	RTU-SV-16**	24" SV-16 (CH-332.80Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
21	RTU-SV-17**	24" SV-17 (CH-348.80Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
22	RTU-SV-18**	24" SV-18 (CH-364.80Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
23	RTU-SV-19**	24" SV-19 (CH-380.80Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
24	RTU-IPS-4**	IPS-4 (CH-396.8Km)	02	14+6	22	20	17+8	45	06	3+3	12	00	00	00	06
25	RTU-SV-20	24" SV-20 (CH-412.80Km)	05	14+0	19	04	17+0	21	02	3+0	05	00	00	00	03
26	RTU-SV-21**	24" SV-21 (CH-428.80Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
27	RTU-SV-22	24" SV-22 (CH-448.80Km)	05	14+0	19	04	17+0	21	02	3+0	05	00	00	00	03
28	RTU-SV-23**	24" SV-23 (CH-460.80Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
29	RTU-SV-24**	24" SV-24 (CH-476.80Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
30	RTU-SV-25	24" SV-25 (CH-499Km)	05	14+0	19	04	17+0	21	02	3+0	05	00	00	00	03
31	RTU-R/T Bangalore**	Receiving Terminal at Bangalore (Singasandra)	12	0+6	18	18	5+8	31	04	0+3	07	02	00	02	08
32	RTU-SV-1(M)	24" SV-1(M) (CH-15.900Km)	05	14+0	19	04	17+0	21	02	3+0	05	00	00	00	03

33	RTU-SV-2(M)	24” SV-2(M) (CH-31.455Km)	05	14+0	19	04	17+0	21	02	3+0	05	00	00	00	03
34	RTU-SV-3(M)**	24” SV-3(M) (CH-46.008Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
35	RTU-SV-4(M)**	24” SV-4(M) (CH-63.739Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
36	RTU-SV-5(M)**	24” SV-5(M) (CH-80.859Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
37	RTU-IPS-1(M)**	IPS- 1(M) (CH- 96.423Km)	02	14+6	22	20	17+8	45	06	3+3	12	00	00	00	06
38	RTU-SV-6(M)**	24” SV-6(M) (CH-111.256Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
39	RTU-SV-7(M)**	24” SV-7(M) (CH-131.008Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
40	RTU-SV-8(M)**	24” SV-8(M) (CH-148.303Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
41	RTU-SV-9(M)	24” SV-9(M) (CH-162.424Km)	05	14+0	19	04	17+0	21	02	3+0	05	00	00	00	03
42	RTU-SV-10(M)**	24” SV-10(M) (CH-178.507Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
43	RTU-IPS-2(M)**	IPS- 2(M) (CH-195.166Km)	02	14+6	22	20	17+8	45	06	3+3	12	00	00	00	06
44	RTU-SV-11(M)**	24” SV-11(M) (CH-212.127Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
45	RTU-SV-12(M)**	24” SV-12(M) (CH-225.937Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
46	RTU-SV-13(M)	24” SV-13(M) (CH-242.388Km)	05	14+0	19	04	17+0	21	02	3+0	05	00	00	00	03
47	RTU-SV-14(M)**	24” SV-14(M) (CH-254.898Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
48	RTU-SV-15(M)**	24” SV-15(M) (CH-275.644Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04

49	RTU-IPS-3(M)**	IPS- 3(M) (CH- 292.315Km)	02	14+6	22	20	17+8	45	06	3+3	12	00	00	00	06
50	RTU-SV-16(M)**	24" SV-16(M) (CH-308.00Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
51	RTU-SV-17(M)**	24" SV-17(M) (CH-324.72Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
52	RTU-SV-18(M)**	24" SV-18(M) (CH-341.05Km)	05	14+6	25	04	17+8	29	02	3+3	08	00	00	00	04
53	RTU-R/T Mangalore**	Receiving Terminal at Mangalore (CH- 354.328Km)	12	0+6	18	18	5+8	31	04	0+3	07	02	00	02	08

NOTES:

1. In addition to above quantities; 25% Spare I/Os shall be provided for each station.
2. The I/Os marked (" * ") are the tentative I/Os as per P & ID. Refer Instruments Index enclosed. Detail Engineering based on P&ID and Instruments Index for finalization of I/O counts is in bidder's scope.
3. The I/Os marked (" # ") are the tentative I/Os typically has to be considered for Electrical (Solar, Fire & Safety and UPS) & Cathodic Protection System(CP).
4. The counts of I/Os will be finalized during detail engineering.
5. Bidder shall provide station wise maximum power consumption details.
6. Minimum 4 nos. of Spare serial each of RS-232 and RS-485 ports shall be provided to all RTU's in addition to above indicated quantity as per PJS Clause no. 6.6 (Page no. 06 of 24).
7. Serial port includes for Electrical (Solar, Fire & Safety and UPS) and Cathodic Protection System (CP).
8. I/O Count for RTU-IPS-1 are inclusive of Despatch facilities for both Bangalore & Mangalore pipeline.
9. The I/Os marked (" ** ") are the tentative CP station locations. Location may change and it will be finalised during detailed engineering/ FAT.
10. If during detail engineering any additional card has to be added, then same will be paid as per rates available in the SOR, however wiring, erection etc will be in bidder's scope.

ANNEXURE – III

INSPECTION AND TESTING

ANNEXURE-III to PJS

RTU FOR CENTRALISED SCADA SYSTEM

INSPECTION AND TESTING

1.0 INSPECTION

All equipment and components of the system shall be subjected to inspection and testing both during and upon completion of manufacturing and at site. Bidder shall provide full details of all type tests carried out on boards and modules and tests normally carried out in their works including to what standards these are carried out. These test preferably in accordance with International / National Standards.

1.1 All factory tests will be witnessed by Client / Consultant.

1.2 Client / Consultant shall have free entry and access at all phases of the project to all parts of Bidder's facilities associated with manufacturing and testing of system.

1.3 Bidder shall invite Client / Consultant well in advance with minimum 2 months notice of the date at which the system is ready for testing.

1.4 The equipment will not be shipped before they have been officially released in the form of release notes by Client / Consultant.

1.5 Bidder shall provide Client / Consultant with all reasonable facilities necessary to determine compliance to the system specification.

1.6 Bidder to note that acceptance of the equipments and the system of inspection and testing shall in no way absolve the bidder of his responsibility to deliver the equipment meeting all the requirements specified in the specification. Bidder shall be responsible till the completion of the warranty, for any corrections/modifications including supply and implementation of hardware & software to fulfil the requirements of the contract. If after acceptance of the system certain changes are required such as debugging of the software supplied or any other related issues which cannot be ascertained during the final handover of the system, these changes shall be carried out by the vendor at their cost

1.7 Bidder personnel shall be actively involved during factory acceptance and site acceptance testing.

2.0 TESTING

Testing shall concern SCADA equipments at all stations including RTUs and application software system. The test shall consist of:

a) Pre-Factory Acceptance Test (Pre-FAT)
b) Factory Acceptance Testing (FAT)
c) Pre-Site Acceptance Test (Pre-SAT)
d) Site Acceptance Test (SAT)

e) Test Run

Bidder shall submit to Client / Consultant detailed test plans and procedures, three months prior to all actual testing for factory and site acceptance test and run over review.

2.1 **PRE-FAT**

During the PRE-FAT testing phase, the Bidder is to ensure that system performs in compliance to specifications of the tender, FDS prior to offering the system for FAT by Client / Consultant.

PRE-FAT shall be conducted based on the approved FAT documentation signed by system engineering group of the bidder and On successful clearance of PRE-FAT, the Bidder shall make available to the Client / Consultant, the PRE-FAT signed and approved reports and thereafter clearance for conducting the FAT by Client / Consultant shall be given as above.

2.2 **FACTORY ACCEPTANCE TESTING (FAT)**

2.2.1 The Bidder shall prepare FAT documentation covering all hardware, software including SCADA software and system functionalities including system expansion requirements and submit it 3 months in advance for Client / Consultant review and approval. Factory acceptance test will be done based on the stipulations in the approved FAT document, which shall completely fulfil the contract requirements and approved SCADA/RTU FDS documents.

2.2.2 FAT shall be carried out in SCADA/ RTU vendor's premises. FAT shall cover the testing & Integrated SCADA/RTU System with RTUs

Testing shall systematically, fully and functionally test all the hardware and software in the presence of Client / Consultant inspectors to ascertain compliance with the contract document and approved FDS documents. Test Bed shall be prepared with all the equipments (SCADA Servers, HMI, RWSs, RTUs, Routers, and Peripherals etc) interconnected to actual configuration to perform the testing of integrated SCADA system. All the workstation desks, cabinets with mounting, wiring, interconnection of the equipments shall be available for this testing.

The equipment to be supplied shall be type-tested for electromagnetic Compatibility.

2.2.3 The SCADA system / RTU testing shall cover the following aspects as a minimum:

a) Visual and mechanical testing to ensure correct, proper, good and neat workmanship.

b) Demonstration of the complete system functionalities, hardware & software compliances wit all the equipments including RTUs.

c) Checking of complete database definitions for the proper system configuration.

d) Testing of system passwords and security features.

e) Testing the synchronization of clock between the nodes of each MS and the RTUs as per the specification.

f) Checking of various Tog formats, reports, archiving functions.

g) Checking of system loading w.r.t CPU, memory, disk, as per the requirements.

h) Checking of system diagnostics for all the equipments as per the requirements, power failure and system restarts.

i) Redundancy check for dual communication channel.

j) 10 & Serial communication checking by simulation

k) System building procedures and verifications.

l) Pipeline shutdown and various sequences and interlocks as per pipeline Operation and Control Philosophy.

2.2.4 On line testing, Commissioning

2.2.4.1 Prior to SAT, all RTUs shall be tested online by RTU vendor when all the dispatched, SV, IP, receiving station hardware & software w.r.t RTU system have been successfully tested, with regard to correctness of complete database using plant simulator, remote diagnostics, proper representation of all RTUs data on graphics, alarms, trending, reports etc., checking of operation of various control commands i.e. valves open/close, pipeline shutdown and permissive etc., complete checking and testing of signals from Inst panels to RTU & RTU to Inst panel checking of field values, field device status, controls of field devices commands and set points from MS / EMS. Complete checking and testing of signals and RTU I/o's database points from Inst panel cabinets to RTUs, testing of serial interfaces with Inst panel & Solar panel shall be included in the on-line testing of RTUs.

2.2.4.2 Prior to SAT, the activities of installation, RTUs on-line testing and commissioning shall be performed by RTU vendor by following their Company standard & established practices & procedures to ensure that good techniques and best engineering practices had been followed, while ensuring correctness & completeness of the same.

2.2.4.3 SAT shall be conducted by the RTU vendor after successful integration & commissioning of the complete system and after all actual field signals have been interfaced with the RTU system including the successful completion of on-line testing of all the RTUs.

3.0 SITE ACCEPTANCE TESTING (SAT)

3.1 The Bidder shall prepare SAT test plans and procedures document for integrated system & submit it 1 month in advance of Client / Consultant review and approval.

3.2 SAT shall involve integrated testing of complete RTU / SCADA system. Site Acceptance Testing will be done based on the stipulations in the approved SAT document. Once the test is successfully performed, then the system would be ready for commencement of test run.

3.3 SAT shall be done inline with FAT, wherein simulated signals shall be replaced by actual field signal and integration with Telecom system has been carried out.

3.4 SAT shall be conducted by the experienced system engineering group of the vendor (having experience and involved in system design, engineering, integration & FAT.)

4.0 TEST RUN

Test for continuous functional operation of the system with the required system reliability and availability. This test aims at keeping the complete integrated system operation for a period of 30 days for all the 24 hours a day.

In case of failure, the test will be restarted till the system operates without failure of any system functionality for 30 days. Failure of test shall be limited to such system failures which will affect system availability and reliability and shall not be dependent upon established failure of third party supplied items. Client / Consultant shall have the right to reject the complete system or part there of in the event of two successive failures of test run.

The 'Test Run' will be carried out after the commissioning of complete pipeline duly witnessed by Client / Consultant. After the successful completion of Test run, Warranty phase will start and system taking over certificate will be issued by the Client / Consultant.

4.1 **TEST REPORTS**

The observations, exceptions and test result obtained during the various test shall be documented and produced in the form of a report by the Bidder within 15 days of completion of Test Run which shall be subsequently reviewed / approved by Client /Consultant within 10 days of submission of repost. The warranty phase will start only after the approval of documents / acceptance of the system.

5.0 FAILURE OF COMPONENTS

A log of all failed hardware and software modules shall be maintained which shall give date and time of failure, description of the failed components & cards/software along with designation, effect of failure on the system, cause of failure and number of hours of operation of the part before it failed.

Upon failure of the components/cards/modules, the same shall be replaced by better graded components/cards. And the test shall be restarted from the beginning or the previous logical points as the case may be. If after this one replacement the unit of sub-system still fails to meet the specifications, the Bidder shall replace the complete unit or sub-system with one that meets the requirements and restarts the test all over again.

6.0 Bidder shall depute one experienced software & one hardware engineer fully conversant with the system at MS /EMS during the test run, and they will coordinator for APPS system integration with APPS sub-vendor engineer during the test run.

7.0 All the tests will be necessary in connection with the execution of works as per approved document shall be carried out at the Bidder's premise, testing laboratory and work site of the Client / Consultant at Bidder's cost. The Bidder shall provide assistance; instruments, labour and materials as are normally required for the examining, measuring and testing any workmanship as may be selected and required.

8.0 Factory Acceptance Test shall be carried out at Bidder's factory. These tests will encompass all the material and equipment delivered and software pertaining to RTU/ SCADA system including the equipment and software supplied by Bidder and sub-vendor. Pre-FAT report duly witnessed and accepted by the SCADA vendor shall be available for reference during FAT.

9.0 Various observations and test results obtained during the various test shall be documented and produced in the form of a report by the Bidder. Each report shall contain:

a) Purpose.

b) Method.

c) Deviation from procedures described in previously submitted test plans, if any, with cause for the same.

d) Result of test compared with expected results as per the test plan.

e) Exceptions and action plan.

10.0 If a unit or sub-system has failed during the test and is not repaired and made successfully operational or not replaced within four hours of active repair time after the failure, the test shall be suspended and restarted all over again only after the Bidder has placed the device back in to acceptable operation. The Client / Consultant's approval shall be obtained for any allowable logistic time required to replace the failed component/system shall be to Bidder's account.

11.0 The Client / Consultant shall be free to request any specific test on any equipment and the system considered necessary by him, although not listed in the testing documents to verify the compliance with the specifications.

12.0 Any statutory test/inspection certificate, as may be required, under any law or directive issued by Govt. or any competent authority, shall be furnished to the Client / Consultant.

13.0 For operational software tests, the plans shall include summery of the method, a list of typical test cases, the sequence of execution and expected results.

For hardware tests, the plans shall include purpose of the test, definition of test inputs, specifications of test procedures and definition of results to be obtained.

14.0 It shall be Bidder's responsibility to modify the operational and diagnostics software in case of any mal-operation is revealed during online operation of the system after commissioning with in the guarantee period.

15.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PROGRAM/RECORDS

The Bidder shall ensure the quality of all equipment and software delivered, installed and commissioning and all works performed under this Contract according to a Quality Policy and a Quality Assurance Programme submitted along with his Bid.

The Bidder shall submit:

a) Quality Control Plans showing the activities to be examined by Quality Control group of Bidder along with the documentation which shall be maintained and submitted to the Client / Consultant.

b) Quality Control & Quality Assurance organisation set up proposed to be deployed by the Bidder.

c) Procedure for Tests, Calibration, Maintenance of software, Instruments and Equipments.

A log shall also be maintained by the Bidder during the time the system remains at Bidder's works from the time of purchase/putting the system for the purpose until system is cleared to dispatch to India. This log shall be sent along with the system to the Client / Consultant.

ANNEXURE – IV

INSTALLATION & COMMISSIONING

ANNEXURE-IV to PJS

RTU FOR CENTRALISED SCADA SYSTEM

INSTALLATION & COMMISSIONING

1.0 The installation and commissioning of all the equipment at various sites including the activities of instrumentation signal interconnections, electrical and civil works with power supply distribution and grounding works and other necessary facilities is the responsibility of the Bidder.

Trench will be provided by client, erection of foundation channel as per base requirement on trench has to be done by the contractor. All necessary channel, welding, grouting etc has to be done.

2.0 a) All supply and interconnection of cabling and accessories including cable routing between the following cabinets/equipments are also included in Bidder's scope, and to be carried out by the Bidder. The activities of signal identification at site, cable termination, ferruling, glanding, dressing at TIC end, RTU end, telecom rack end etc. are in Bidders scope for all sites.

(i) Between RTUs & Telemetry interface cabinets.
(ii) Between RTUs & Telecommunication equipments.
(iii) Between SCADA (CCUs, WAN routers) & Telecommunication equipments.
(iv) Between Remote workstations & Telecommunication equipments.
(v) Between RTUs and flow computers serial interfacing as required.

b) All cables between TICs and RTUs shall be PVC insulated, single pair (1.5 mm2), multi pair (0.5 mm2), twisted in pair individually, individual pair shielded and overall shielded with aluminium mylar tape. Separate cables for analog and digital cables to be used. The distance between TIC and RTU for each SV, and IP station shall be approx. 15 meters. The cables have to be included accordingly.

Each cable pair shall be identifiable by pair/core no of colour code. The cable shall have multi strand copper conductor. 20% spare pairs shall be provided in all the cables from Telemetry interface cabinet to RTU.

c) The Ethernet cable from RTU to Telecom rack shall be 50 feet long at each station, complete with connectors at each end. However distances shall be firmed up during detail engineering or prior to FAT.

d) RTU/ SCADA vendor shall be responsible for proper selection of the RS 232 C or any other cable for ensuring good communication with telecommunications.

3.0 All the erection work shall be carried out as per the established recommended practices and best workmanship.

4.0 Bidder shall bring all installation aids, test equipments and qualified and experienced personnel, in order to carry out the job successfully. A list of the same shall be submitted to the Client / Consultant for the review.

On completion of erection and installation of all equipment and software, and before start-up, each item of the system shall be jointly inspected by the Client / Consultant and Bidder for

correctness & completeness of the installation and acceptability of start-up leading of commissioning tests at site.

5.0 The list of commissioning test to be performed shall be mutually agreed upon and included in the Bidder's Quality assurance programmes. Bidder's commissioning engineers shall carry out these tests. After the commissioning tests are over, the system shall be put for SAT.

6.0 All technical personnel assigned to the site by Bidder must be fully conversant with the specific system and its software packages. The Bidder's field personnel shall have both hardware & software capability to bring the system online quickly and efficiently and with the minimum of interference with other concurrent construction and commissioning activity.

7.0 The commissioning spares for all the items/equipments shall be included along with commissioning services as required to commission the complete system. The consumable required during commissioning of system shall be included as part of commissioning spares.

Commissioning spares including consumables as part of commissioning activities. Vendor must ensure availability of following commissioning spares as a minimum at site:

a. 2 nos. of CPU and 2 nos. of each type of I/O card (AI, AO, DI, DO, Serial cards) of RTU

b. One no. Router

Mandatory spares as per MR

RTU/ SCADA Vendor to note that the mandatory spares are the inventory of the spares to be kept by the Client and the same shall not be utilised by the RTU/SCADA Vendor at any stage of the project till completion of warranty, without Client's prior concurrence. Any mandatory spares utilized by the RTU/SCADA vendor during Warranty period shall be replenished within 45 days.

8.0 To the extent that the Standard of the works has not been specified in the Contract, the Bidder shall use good quality materials, techniques and standards and execute the Contract with the care, skill and diligence required in accordance with best engineering practice.

9.0 Bidder shall at his own expense supply and provide all the equipment, tools, temporary works material both for temporary and for permanent works, labour, supervisors, engineers and specialist, movement of the supplied equipment at the site, required for installation, commissioning, execution and completion of the works. The Bidder shall make his own arrangements at his own cost for the transport where necessary of his staff and labour to and from the site of the works.

10.0 The Bidder shall provide and maintain an office at the Site, during Installation, Testing & Commissioning phase, for his staff, and such office shall be open at all reasonable hours to receive instructions, notice or other communications as per the advice of the Client / Consultant.

11.0 Appropriate storage of the materials to be supplied in this contract will be arranged at the site by the Bidder at the various stations after the materials have been delivered by the Bidder. The Bidder shall be responsible for the storage, security and safety of all other materials, tools etc. brought by the Bidder for the installation and commissioning of the system at the site.

12.0 The Bidder's responsibility at site shall include all the activities necessary to be performed to complete the entire job as per the contract requirements including the following as a minimum.

a) Receipt of hardware, software and checking the adequacy and completeness of supply.

b) Storage, safety, security of the equipments & other materials including software at site.

c) Installation of the complete system including power supply, earthing, cable terminations, calibration, civil and electrical works.

d) Checking of equipment installation.

e) Checking of interconnection and overall system functionality.

f) On line/Offline debugging of the system.

g) Coordination /interfacing (including obtaining relevant details) with Instrumentation, APPS sub-vendor, CP system & Electrical contractor, Telecom sub-vendor directly or through client for any disputes.

h) On line testing and commissioning of SCADA system and testing of APPS system with sub-vendor.

13.0 For installation, RTUs online testing and commissioning as per the specification of RTU supplier recommendation. After these test, the SCADA system shall be put for SAT.

14.0 RTU / SCADA vendor to note that there could be minor database changes, graphics, report logic changes during site commissioning phase as required by the client / consultant. The same shall be treated as part of the scope of SCADA vendor. This activity will be carried out by other vendor.

ANNEXURE - V
P & ID DRAWINGS FOR ALL STATIONS
(KKBMPL-PH-II)

DRG. NO. MEC/23ME/05/28/M/001/0002

SYMBOLS & ABBREVIATIONS

SYMBOLS

- SHUT-OFF VALVE, GENERAL
- SAFETY SHUT-OFF VALVE
- CONTINIUOUS-ACTION VALVE
- RIGHT-ANGLE SHUT-OFF VALVE, GENERAL
- THREE-WAY VALVE, GENERAL
- FOUR-WAY VALVE, GENERAL
- NEEDLE VALVE
- PUSHBUTTON VALVE
- CHECK VALVE (SPRING TYPE)
- NON RETURN VALVE (SWING TYPE)
- BUTTERFLY VALVE
- CONTINUOUSLY VARIABLE BORE BUTTERFLY VALVE
- LOUVRE
- SEPERATOR GENERAL
- 2 STAGE SEPERATOR
- CYCLONE SEPERATOR
- CONDENSATE TRAP
- FLOWMETER GENERAL
- METER GENERAL
- TURBINE METER
- VORTEX-SHEDDING FLOWMETER
- DIAPHRAGM METER
- MANUALLY OPERATED ACTUATOR, GENERAL
- DIAPHRAGM ACTUATOR
- PISTON ACTUATOR
- ELECTROMAGNETIC ACTUATOR
- HYDRAULIC OR PNEUMATIC ACTUATOR, GENERAL

SYMBOLS

- SPRING-OPERATED ACTUATOR
- AUTOMATICALLY OPERATED ACTUATOR, GENERAL
- ELECTRIC MOTOR-OPERATED ACTUATOR, GENERAL
- VALVE CLOSED ON FAILURE OF ACTUATING ENERGY
- VALVE OPENED ON FAILURE OF ACTUATING ENERGY
- VALVE RETAINS POSITION ON FAILURE OF ACTUATING ENERGY
- TURBINE, GENERAL
- COMPRESSOR, GENERAL
- ROTARY PISTON COMPRESSOR
- PISTON COMPRESSOR
- JET BOOSTER
- FAN, GENERAL
- HEAT EXCHANGER WITHOUT COUNTERFLOW
- COUNTERFLOW HEAT EXCHANGER
- PLATE HEAT EXCHANGER
- FINNED HEAT EXCHANGER WITH VENTILATOR
- BLIND PLATE
- "FIGURE 8" PLATE, BLIND PLATE IN FUNCTION
- "FIGURE 8" PLATE, GOGGLE PLATE IN FUNCTION
- ORIFICE PLATE
- INSULATING FLANGE
- INSULATING COUPLING
- STRAIGHTENING VANES
- RUPTURE DISK
- SIGHT GLASS. GENRAL
- EXPANSION JOINT
- SILENCER
- PULSATION DAMPENER
- MIXING NOZZLE
- CAP
- FLANGE CONNECTION

SYMBOLS

- FILTER, GENERAL
- GAS FILTER, GENERAL
- CARTRIDGE FILTER
- GAS SORPTION FILTER
- LIQUID FILTER, GENERAL
- "Y" TYPE STRAINER
- PRESSURE REDUCING VALVE, IN AUXILIARY AND CONTRAL FACILITIES
- PRESSURE CONTROL VALVE, GENERAL
- PROCESS PRIMARY LINE
- PROCESS SECONDARY LINE
- ELECTRIC LINE
- PNEUMATIC LINE
- CAPILLARY LINE
- INSTRUMENT LINE
- HEAT TRACING LINE
- JACKETED LINE
- JACKETED & HEATED LINE
- VENT STACK
- SCRAPER TRAP
- LIQUID PUMP GENERAL
- CENTRIFUGAL PUMP
- LIQUID RING PUMP
- PISTON PUMP
- DIAPHRAGM PUMP
- CORROSION PROBE
- CORROSION COUPON

ABBREVIATIONS

ESD	EMERGRNCY SHUT-DOWN
EW	DRAIN
FB	FAIL-BLOCKED
GCV	GAS-OPERATED CONTROL VALVE
GOV	GAS-OVER OIL OPERATED VALVE
HOV	HYDRAULIC-OPERATED VALVE
LC	LOCKED CLOSED
LO	LOCKED OPEN
LP	LOCKED POSITION
LPT	LOW POINT
MCV	MOTOR CONTRAL VALVE
MH	MANHOLE
MOV	MOTOR-OPERATED VALVE
SV	SOLENOID VALVE
PCV	PRESSURE CONTROL VALVE
SAV SSV	SAFETY SHUT-OFF VALVE
SBV PRV	PRESSURE RELIFE VALVE
SP	SETPOINT
TE	THERMOCOUPLE
TW	THERMOWELL
NRV	NON-RETURN VALVE
CV	CHECK VALVE
FCV	FLOW CONTROL VALVE
PGS	POWER GAS SUPPLY
IAS	INTRUMENT AIR SUPPLY
NC	NORMAL CLOSED
NO	NORMAL OPEN

ISSUED FOR CONSTRUCTION

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AMIT KUMAR
DRAWN	SUNIL
CHECKED AND VERIFIED	A.K.BHARTI
APPROVED	SKG (G.V.M.)
DATE	08.02.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

LEGEND / DRAWING

SCALE : NTS

DRG. NO. MEC/23ME/05/28/M/001/0002

REV / SEC | INST. | CONCURRED BY

REV.NO | DATE | ZONE | DESCRIPTION | BY | VERIFIED

REVISION

REFERENCES | DRG.NO.

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

DRG. NO. MEC/23ME/05/28/M/001/0001

SYMBOLS & ABBREVIATIONS

SYMBOLS

- VP–PLUG VALVE
- VB–BALL VALVE WELDED END
- VB–BALL VALVE FLANGED END
- GATE VALVE
- GV–GLOBE VALVE
- PRESSURE RELIEF OR SAFETY VALVE (PSV)
- PRESSURE REGULATING VALVE (PCV) (SELF ACTUATING TYPE)
- NON RETURN VALVE
- CONTROL VALVE WITH SLAM SHUT-OFF VALVE
- SOLENOID VALVE
- GAS ACTUATED ISOLATION VALVE
- GAS ACTUATED ISOLATION VALVE WITH HANDWHEEL
- REDUCER
- FLANGE
- FLAME ARRESTOR (FA)
- RTU — REMOTE TERMINAL UNIT
- DIAPHRAM
- XXLS — PIG SIGNALLER
- VENT
- SPECTACLE BLIND

SYMBOLS

- PD METER
- TURBINE METER
- INSULATION JOINT (IJ)
- FLOW TEE (FWT)
- FIELD MOUNTED INSTRUMENT
- CONTROL PANEL MOUNTED INSTRUMENT
- ULTRASONIC METER
- SCADA INDICATOR, CONTROLLER OR OTHER DEVICES WITH OPERATOR ACCESS TO ADJUSTMENT.

ABBREVIATIONS

AE	ANALYZER SENSOR (GAS CHROMATOGRAPH)
AI	ANALYZER INDICATOR
AT	ANALYZER TRANSMITTER
FY	FLOW COMPUTER
FQI	FLOW TOTALIZER & INDICATOR
LG	LEVEL GAUGE
ZSH/ZSL	LIMIT SWITCHES (OPEN/CLOSE)
TI/TG	TEMPERATURE INDICATOR/ GAUGE
TE	TEMPERATURE ELEMENT
TW	THERMOWELL
DPI/DPG	DIFF. PRESSURE INDICATOR/ GAUGE
DPT	DIFF. PRESSURE TRANSMITTER
PI/PG	PRESSURE INDICATOR/ GAUGE
PT	PRESSURE TRANSMITTER
FC/FO	FAILURE TO CLOSE/OPEN
LO	LOCK OPEN
FIC/PIC	FLOW/PRESS. INDICATING CONTROLLER
I	INTERLOCK
XRL	LOCAL/REMOTE INDICATION
XSL	LOCAL/REMOTE SWITCH
HSH	HAND SWITCH HIGH
HSL	HAND SWITCH LOW
FT	FLOW TRANSMITTER
FE	FLOW ELEMENT
Q.O.E.C.	QUICK OPENING END CLOSURE

ABBREVIATIONS

TT	TEMP TRANSMITTER
FR	FLOW RECORDER
PIR	PRESSURE IND.RECORDER
TIR	TEMP. IND. RECORDER
PSH	PRESSURE SWITCH HIGH
PSL	PRESSURE SWITCH LOW
LSH	LEVEL SWITCH HIGH
LSL	LEVEL SWITCH LOW
LAH	LEVEL ALARM HIGH
LAL	LEVEL ALARM LOW
D	CONDENSATE DRAIN
A1A/B1A	150#/300# RATING
C1A/D1A	400#/600# RATING
LX/PX	PNEUMATIC/ ELECTRIC SIGNAL TRANSMITTER
FB	FULL BORE
SP	SAMPLER
NG	NATURAL GAS
V	VENT
AS	AUTO SAMPLER
CP	CORROSION PROBE
CC	CORROSION COUPON
AV	ACTUATED VALVE
SDV	SHUT DOWN VALVE
LV	LEVEL CONTROL VALVE
PV/PCV	PRESSURE CONTROL VALVE
FCV	FLOW CONTROL VALVE

AREA–00"–FLUID–00–00–A1A/B1A/C1A/D1A/D4A

- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- (NG–NATURAL GAS/ V–VENT/ D–DRAIN)
- LINE SIZE (NOMINAL)
- KOCHI/KOTTANAD/BANGLORE/MANGLORE(PH–2)

ISSUED FOR CONSTRUCTION

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

KOCHI–KOTTANAD–BANGLORE–MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

LEGEND / DRAWING SYMBOLS

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AMIT KUMAR
DRAWN	SUNIL
CHECKED AND VERIFIED	A.K.BHARTI
APPROVED	
DATE	08.02.2011
SCALE	NTS
DRG. NO.	MEC/23ME/05/28/M/001/0001
REV.	0

REV / SEC | INST. | CONCURRED BY

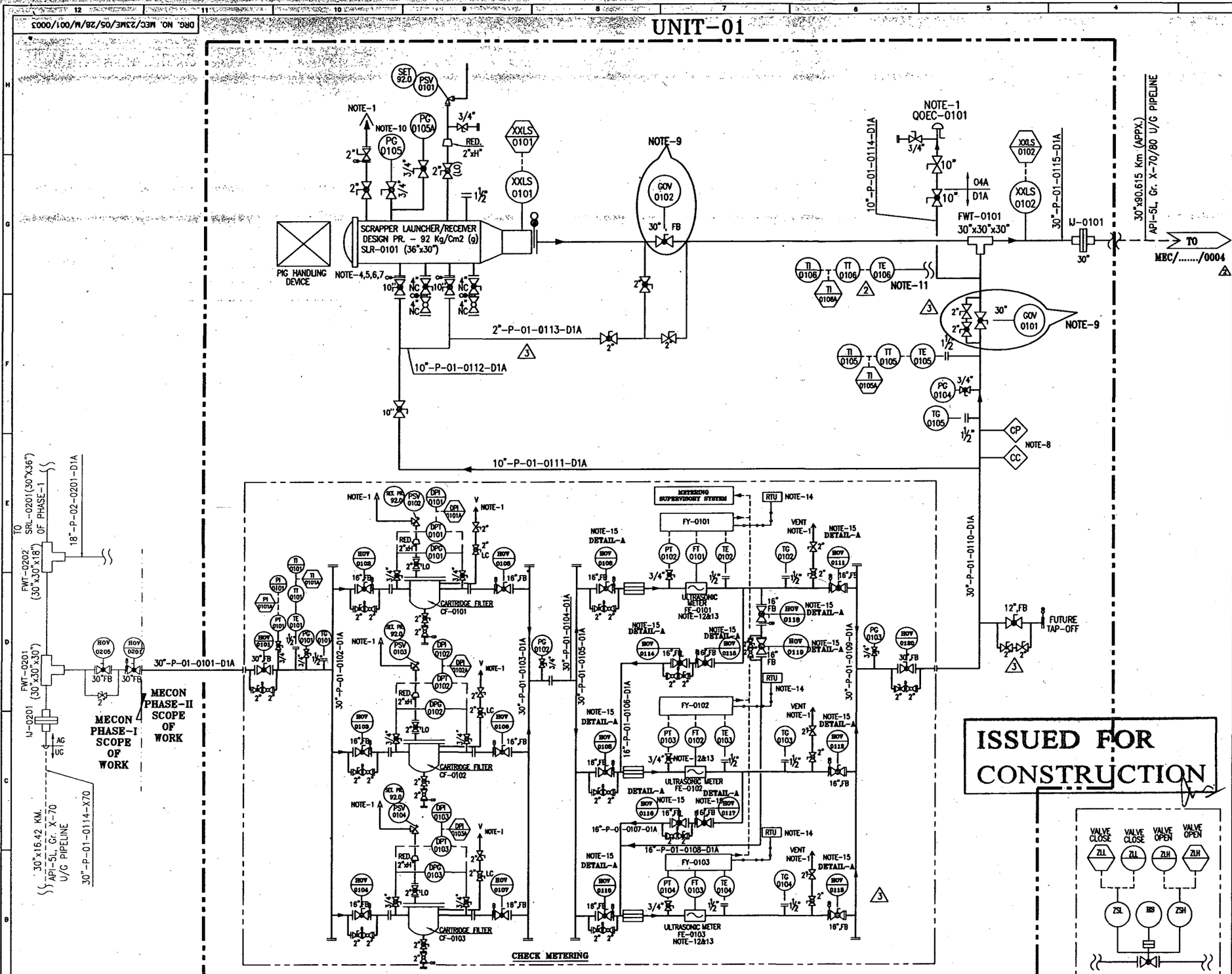
REV.NO | DATE | ZONE | DESCRIPTION / REVISION | BY | VERIFIED

REFERENCES | DRG.NO.

© Copyright MECON LIMITED - All rights reserved. THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

DRG. NO. MEC/23ME/05/28/M/001/0003

UNIT-01



DESPATCH FACILITY AT IPS-1 OF PHASE-1 PIPELINE FOR BANGALORE-MANGALORE PHASE-2 PIPELINE

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
3. ALL UNMANNED STATION SHALL BE PROVIDED WITH CO2 FLOODING SYSTEM AND ALL MANNED STATION SHALL BE WITH FM-200 FIRE SUPPRESSION SYSTEM.
4. SCRAPPER TRAP SHALL HAVE FEATURE FOR WORKING AS LAUNCHER AS WELL AS RECEIVER i.e. BI-DIRECTIONAL.
5. SCRAPPER DOOR MECHANISM TO BE CONSTRUCTED SUCH THAT THE DOOR CAN NOT BE OPENED UNLESS SCRAPPER TRAP IS FULLY DEPRESSURISED.
6. SCRAPPER LAUNCHER / RECEIVER SHALL BE SUIATABLE FOR HANDLING INTELLIGENT PIGS.
7. DELETED.
8. ONLINE RETRIVEL TYPE CORROSION MONITORING COUPON AND CORROSION PROBE SHALL BE PROVIDED.
9. FOR SV & GOV DETAIL REFER ORG. NO. MEC/23ME/05/28/M/001/0023-0030
10. PG-0105 SHALL HAVE A RANGE OF 0-1 Kg/Cm2(g) WITH A GAUGE SAVER.
11. DIRECT SURFACE CONTACT TYPE.
12. METERING SHALL BE DONE BY ULTRASONIC FLOW METER WITH CONTROL PANEL MOUNTED FLOW COMPUTER. INSTALLATION SHALL BE AS PER AGA9 LATEST EDITION. HOWEVER THERE SHALL BE THREE STREAMS OF METERING (2W+1S).
13. ENVIRONMENTAL ENCLOSURE REQUIRED FOR METERING INSTRUMENTS. INSULATION OF USM METER, METER RUN & IMPLUSE LINES OF METERING INSTRUMENT IS REQUIRED.
14. PROVISION SHALL BE KEPT TO HOOK UP METERING PR. & TEMP., FLOW PARAMETERS WITH SCADA.
15. THESE VALVES ACROSS THE USM SHALL BE PROVIDED WITH LIMIT SWITCHES.
16. TOTAL FLOW FOR PHASE-I & PHASE-II IS CONSIDERED MAX. 26.205 MMSCMD (APPX.)WHERE PHASE-II FLOW IS CONSIDERED MAX. 17.70 MMSCMD (APPX.) CONSIDERING PHASE-I FLOW MAX. 8.5 MMSCMD (APPX.) (GAIL HAS TO CONFIRM).

PROCESS DATA

FLUID	: NATURAL GAS/RLNG	TEMPERATURE WORKING	: 0°-55° C
FLOW	: 17.705 MMSCMD (APPX.)	DESIGN	: -29 TO 65°C
PRESSURE	: 84-90 KG/Cm2(G)	DESIGN CLASS	: 600#
DESIGN	: 92 KG/Cm2(G)		

LINE LEGEND

- EXISTING LINE A/G
- EXISTING LINE U/G
- PROPOSED LINE A/G
- PROPOSED LINE U/G

30"-P-01-0101-D1A
10"-P-01-0101-D1A
(MATERIAL SPEC. / LINE NO. / UNIT NO. / PROCESS FLUID (RLNG) / LINE SIZE (NOMINAL))

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW ENO.
- PLUG VALVE BW END/UPTO 1½" SW ENO.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED
मेकॉन लिमिटेड
MECON LIMITED

REV	DATE	ZONE	REVISION	BY	VERIFIED
3	03.02.12		REVISED AS MARKED 3	AKB	GVW
2	28.09.11		AS PER GAIL'S COMMENTS	AKB	GVW
1	28.05.11		GENERAL REVISION	AKB	GVW

PIPELINE NETWORK SCHEMATIC DIAGRAM — REFERENCES — DRG.NO. MEC/23ME/05/28/M/001/0021

© Copyright MECON LIMITED - All rights reserved. THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SIG (Q.V.W.)
DATE	08.02.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

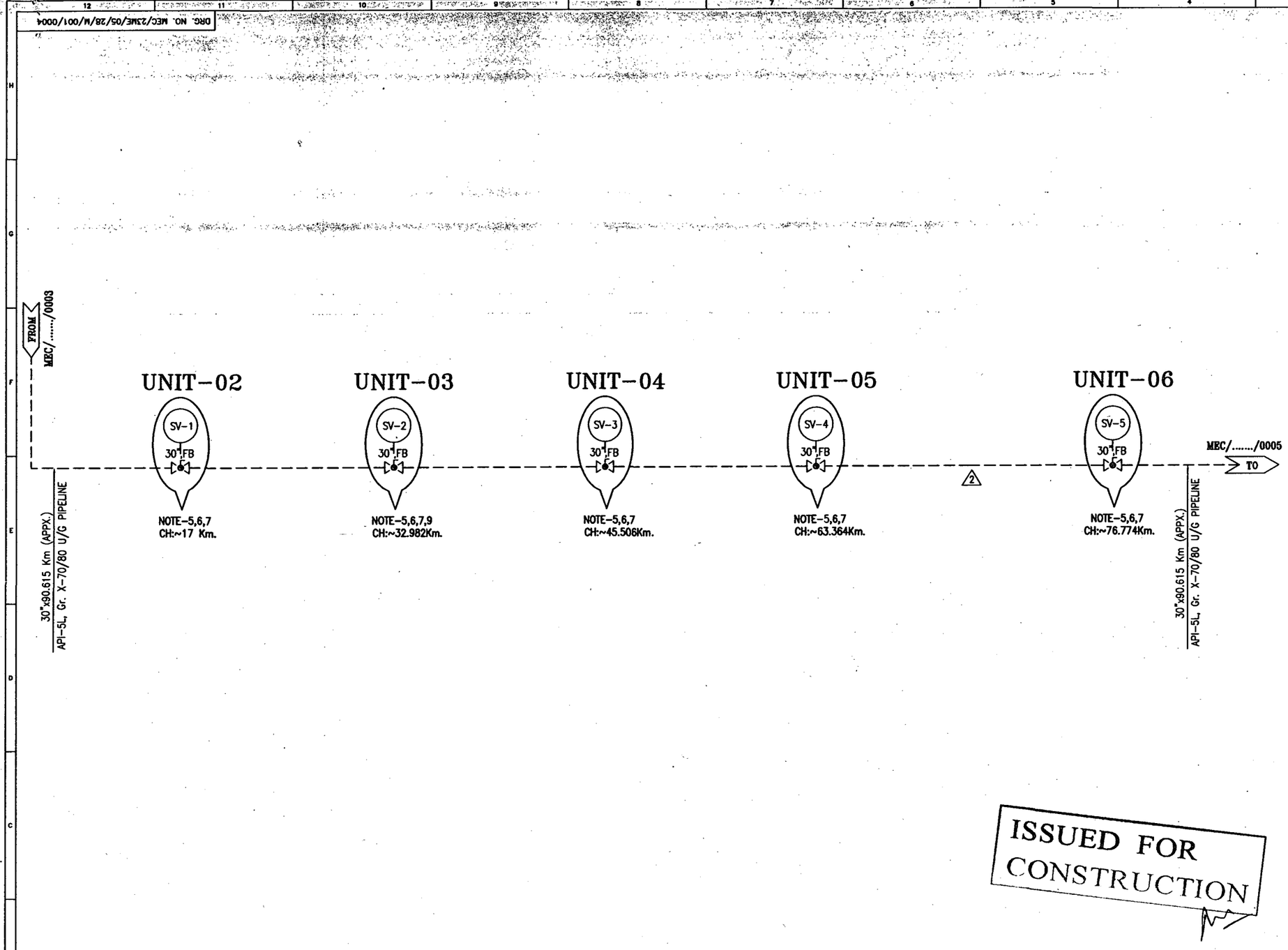
P & ID FOR DESPATCH FACILITY AT IPS-1 OF PHASE-1 PIPELINE FOR BANGALORE-MANGALORE PHASE-2 PIPELINE (SECTION-I)

SCALE : NTS | REV 3

DRG. NO. MEC/23ME/05/28/M/001/0003

REV / SEC | INST. | CONCURRED BY

DRG. NO. MEC/23ME/05/28/M/001/0004



ISSUED FOR CONSTRUCTION

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. NOTE DELETED.
3. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
4. ALL UNMANNED STATION SHALL BE PROVIDED WITH CO2 FLOODING SYSTEM AND ALL MANNED STATION SHALL BE WITH FM-200 FIRE SUPPRESSION SYSTEM.
5. ALL SV EXTENDED STEM, BW, FULL BORE BALL VALVE.
6. BURRIED VALVE SHALL BE PROVIDED WITH CORROSION PROTECTION COATING.
7. FOR SV & GOV DETAIL REFER DRG. NO. MEC/23ME/05/28/M/001/0023-0030
8. ALL SV STATIONS & TAP-OFF CHAINAGES HAS TO BE CONFIRMED BY GAIL.
9. FOR SV-2 SEE TYP. DRG. NO. MEC/23ME/05/28/M/001/0028
10. ALL SV STATIONS WITHIN KERALA STATE, SV's HAVING FIXED CONSUMERS & SV-26, 27 (NEAR CITY) ARE CONSIDERED WITH FUTURE TAP-OFF. HOWEVER OUT OF REST NINE No. SV's FIVE No. OF THEM ARE WITH FUTURE TAP-OFF & FOUR No. ARE WITHOUT FUTURE TAP-OFF (TO BE DECIDED ON THE BASIS OF GEOGRAPHICAL LOCATION OF SV STATION).

PROCESS DATA

FLUID	: NATURAL GAS/RLNG	TEMPERATURE	
FLOW	: 17.66 MMSCMD (APPX.)	WORKING	: 0°-55° C
PRESSURE	: 78-85 KG/Cm2(G)	DESIGN	: -29 TO 65°C
DESIGN	: 92 KG/Cm2(G)	DESIGN CLASS	: 600#

LINE LEGEND

- EXISTING LINE A/G
- EXISTING LINE U/G
- PROPOSED LINE A/G
- PROPOSED LINE U/G

30"-P-01-0101-D1A

- 30" — LINE SIZE (NOMINAL)
- P — PROCESS FLUID (RLNG)
- 01 — UNIT NO.
- 0101 — LINE NO.
- D1A — MATERIAL SPEC.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1 1/2" SW END.
- PLUG VALVE BW END/UPTO 1 1/2" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

REV	DATE	ZONE	DESCRIPTION / REVISION	BY	VERIFIED
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVM
1	26.05.11		GENERAL REVISION	AKB	GVM

REV / INST. / SEC — CONCURRED BY

PIPELINE NETWORK SCHEMATIC DIAGRAM — REFERENCES — DRG.NO. MEC/23ME/05/28/M/001/0021

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS		
LOCATION	DELHI		
DESIGNED	AKB		
DRAWN	SUNIL		
CHECKED AND VERIFIED	GVM		
APPROVED	SIG (G.V.M.)		
	DATE	08.02.2011	

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

P & ID FOR SV STATIONS ALONG THE PIPELINE FOR BANGALORE-MANGALORE PHASE-2 PIPELINE (SECTION-I)

SCALE : NTS | SHEET | REV

DRG. NO. MEC/23ME/05/28/M/001/0004 | 2

DRG. NO. MEC/23ME/05/28/M/001/0005

UNIT-07

RECEIVING FACILITY AT IPS-1

DESPATCH FACILITY AT IPS-1

FROM MEC/...../0004

30"x90.615 KM. API-5L, Gr. X-70/80 U/G PIPELINE

IJ-0701 FWT-0701 (30"x30"x24") FWT-0702 30"x30"x24"

30"-P-07-0701-D1A

NOTE-1 QOEC-0701

XXLS 0701 XXLS 0702

D4A D1A 10"

GOV 07D1 FB 30"

NOTE-8

SCRAPPER RECEIVER/LAUNCHER SRL-0701 (30"x36") DESIGN PR. - 92 Kg/Cm2 (g)

NOTE-2,3,4&5

NOTE-1 VENT

SET 92.0 PSV 0701 PSV 0702

PG 0701 PG 0701A PG 0706 PG 0706A

NOTE-10

RED. 2"xH"

SCRAPPER LAUNCHER/RECEIVER SLR-0701 (30"x24") DESIGN PR. - 92 Kg/Cm2 (g)

XXLS 0703 GOV 0704 24" FB

FWT-0703 24"x24"x24"

24"-P-07-0717-D1A

XXLS 0704

IJ-0702 24"

TO MEC/...../0006

24"x439.085 Km.(APPX.) API-5L, Gr. X-70/80 U/G PIPELINE

SECTION-II

SECTION-I

10"-P-07-0713-D1A

2"-P-07-0714-D1A

10"-P-07-0715-D1A

2"-P-07-0716-D1A

24"-P-07-0711-D1A

10"-P-07-0712-D1A

24"-P-07-0718-D1A

TO MEC/...../0015

GOV 0702 GOV 0703

TE 0701 TT 0701 TI 0701 TI 0701A

NOTE-11

TI 0702 TT 0702 TE 0702 TI 0702A

CP CC NOTE-7

PG D702 TG 0701

24"-P-07-0702-D1A

CARTRIDGE FILTER CF-0701 CF-0702 CF-0703

24"-P-01-0703-D1A 24"-P-01-0704-D1A 24"-P-07-0705-D1A 24"-P-07-0706-D1A 12"-P-07-0707-D1A 12"-P-07-0708-D1A 12"-P-07-0709-D1A 24"-P-07-0710-D1A

METERING SUPERVISORY SYSTEM RTU NOTE-14

FY-0701 FY-0702 FY-0703

PT 0702 FT 0701 TE 0704 PT 0703 FT 0702 TE 0705 PT 0704 FT 0703 TE 0706

ULTRASONIC METER FE-0701 FE-0702 FE-0703 NOTE-12&13

TG 0703 TG 0704 TG 0705

NOTE-15 DETAIL-A

12"FB FUTURE TAP-OFF

BDV 0706 BDV 0707 BDV 0708 BDV 0709

NOTE-9

DETAIL-A

VALVE CLOSE ZIL VALVE CLOSE ZIL VALVE OPEN ZIH VALVE OPEN ZIH

ZSL BS ZSH

DETAIL-A

INTERMEDIATE PIGGING STATION-1
CH. 90.615 Km. (APPROX.)

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST LEVEL.
2. SCRAPPER LAUNCHER/RECEIVER SHALL HAVE SCRAPPER HANDLING FACILITY COMPIRING OF A JIB CRANE & A TROLLY AND SHALL HAVE A QUICK OPPENING CLOSURE.
3. SCRAPPER LAUNCHER/RECEIVER SHALL BE SUITABLE FOR HANDLING INTELLIGENT PIGS.
4. DELETED.
5. SCRAPPER DOOR MECHANISM TO BE CONSTRUCTED SUCH THAT THE DOOR CAN NOT BE OPENED UNLESS SCRAPPER TRAP IS FULLY DEPRESSURISED.
6. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
7. ONLINE RETRIVEL TYPE CORROSION MONITORING COUPON AND CORROSION PROBE SHALL BE PROVIDED.
8. FOR SV & GOV DETAIL REFER DRG. NO. MEC/23ME/05/28/M/001/0023-0030
9. FUTURE PROVISION (TAP-OFF) PROVIDED FOR COMPRESSOR STATION.
10. PG-0701 & 0706 SHALL HAVE A RANGE OF 0-1 Kg/Cm2(g) WITH A GAUGE SAVER.
11. DIRECT SURFACE CONTACT TYPE.
12. METERING SHALL BE DONE BY ULTRASONIC FLOW METER WITH CONTROL PANEL MOUNTED FLOW COMPUTER. INSTALLATION SHALL BE AS PER AGA9 LATEST EDITION. HOWEVER THERE SHALL BE THREE STREAMS OF METERING (2W+1S).
13. ENVIRONMENTAL ENCLOSURE REQUIRED FOR METERING INSTRUMENTS. INSULATION OF USM METER RUN & IMPLUSE LINES OF METERING INSTRUMENT IS REQUIRED.
14. PROVISION SHALL BE KEPT TO HOOK UP METERING PR. & TEMP., FLOW PARAMETERS WITH SCADA.
15. THESE VALVES ACROSS THE USM SHALL BE PROVIDED WITH LIMIT SWITCHES.

PROCESS DATA

FLUID	: NATURAL GAS/RLNG	TEMPERATURE	
		WORKING	: 0° TO 55° C
FLOW	: 10.607 MMSCMD (APPX.)	DESIGN	: -29 TO 65°C
PRESSURE	: 75-78 KG/Cm2(G)	DESIGN CLASS	: 600#
DESIGN	: 92 KG/Cm2(G)		

LINE LEGEND

PROPOSED LINE A/G

PROPOSED LINE U/G

24"-P-07-07D1-D1A
12"-P-D7-0701-D1A
- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (RLNG)
- LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

ISSUED FOR CONSTRUCTION

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

REV.NO	DATE	ZONE	DESCRIPTION	BY	VERIFIED
3	03.02.12		REVISED AS MARKED 3	AKB	GVW
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVW
1	28.05.11		GENERAL REVISION	AKB	GVW

PIPELINE NETWORK SCHEMATIC DIAGRAM — MEC/23ME/05/28/M/001/0021

REFERENCES — DRG.NO.

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SIG (G.V.W.)
DATE	08.02.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

P & ID FOR INTERMEDIATE PIGGING STATION-1 (SECTION-I)

SCALE : NTS

DRG. NO. MEC/23ME/05/28/M/001/0005 — REV 3

REV / SEC — INST. — CONCURRED BY

DRG. NO. MEC/23ME/05/28/M/001/0006

FROM MEC/...../0005

UNIT-08 | UNIT-09 | UNIT-10 | UNIT-11 | UNIT-12

SV-6 24"FB — NOTE-5,6,7 CH:~108.545Km.

SV-7 24"FB — NOTE-5,6,7 CH:~123.730Km.

SV-8 24"FB — NOTE-5,6,7 CH:~138.704Km.

SV-9 24"FB — NOTE-5,6,7,9 CH:~157.001Km.

SV-10 24"FB — NOTE-5,6,7 CH:~173.080Km.

2

MEC/...../0007 TO

24"x439.085 Km.(APPX.) API-5L, Gr. X-70/80 U/G PIPELINE

24"x439.085 Km.(APPX.) API-5L, Gr. X-70/80 U/G PIPELINE

ISSUED FOR CONSTRUCTION

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. NOTE DELETED.
3. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
4. ALL UNMANNED STATION SHALL BE PROVIDED WITH CO2 FLOODING SYSTEM AND ALL MANNED STATION SHALL BE WITH FM-200 FIRE SUPPRESSION SYSTEM.
5. ALL SV EXTENDED STEM, BW, FULL BORE BALL VALVE.
6. BURRIED VALVE SHALL BE PROVIDED WITH CORROSION PROTECTION COATING.
7. FOR SV & GOV DETAIL REFER DRG. NO. MEC/23ME/05/28/M/001/0023-0030
8. ALL SV STATIONS & TAP-OFF CHAINAGES HAS TO BE CONFIRMED BY GAIL.
9. FOR SV-9 SEE TYP. DRG. NO. MEC/23ME/05/28/M/001/0027.
10. ALL SV STATIONS WITHIN KERALA STATE, SV's HAVING FIXED CONSUMERS & SV-26, 27 (NEAR CITY) ARE CONSIDERED WITH FUTURE TAP-OFF. HOWEVER OUT OF REST NINE No. SV's FIVE No. OF THEM ARE WITH FUTURE TAP-OFF & FOUR No. ARE WITHOUT FUTURE TAP-OFF (TO BE DECIDED ON THE BASIS OF GEOGRAPHICAL LOCATION OF SV STATION).

PROCESS DATA

FLUID : NATURAL GAS/RLNG	TEMPERATURE
FLOW : 10.552 MMSCMD (APPX.)	WORKING : 0° TO 55° C
PRESSURE : 64-76 KG/Cm2(G)	DESIGN : -29 TO 65°C
DESIGN : 92 KG/Cm2(G)	DESIGN CLASS : 600#

LINE LEGEND

——— PROPOSED LINE A/G

— — — PROPOSED LINE U/G

24"-P-07-0701-D1A
- 24" — LINE SIZE (NOMINAL)
- P — PROCESS FLUID (RLNG)
- 07 — UNIT NO.
- 0701 — LINE NO.
- D1A — MATERIAL SPEC.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
1	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVW
0	28.05.11		GENERAL REVISION	AKB	GVW

REFERENCES

PIPELINE NETWORK SCHEMATIC DIAGRAM	MEC/23ME/05/28/M/001/0021

© Copyright MECON LIMITED - All rights reserved. THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SIG (G.V.W.)
	DATE 08.02.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

P & ID FOR SV STATIONS ALONG THE PIPELINE FOR BANGALORE-MANGALORE PHASE-2 PIPELINE (SECTION-II)

SCALE : NTS

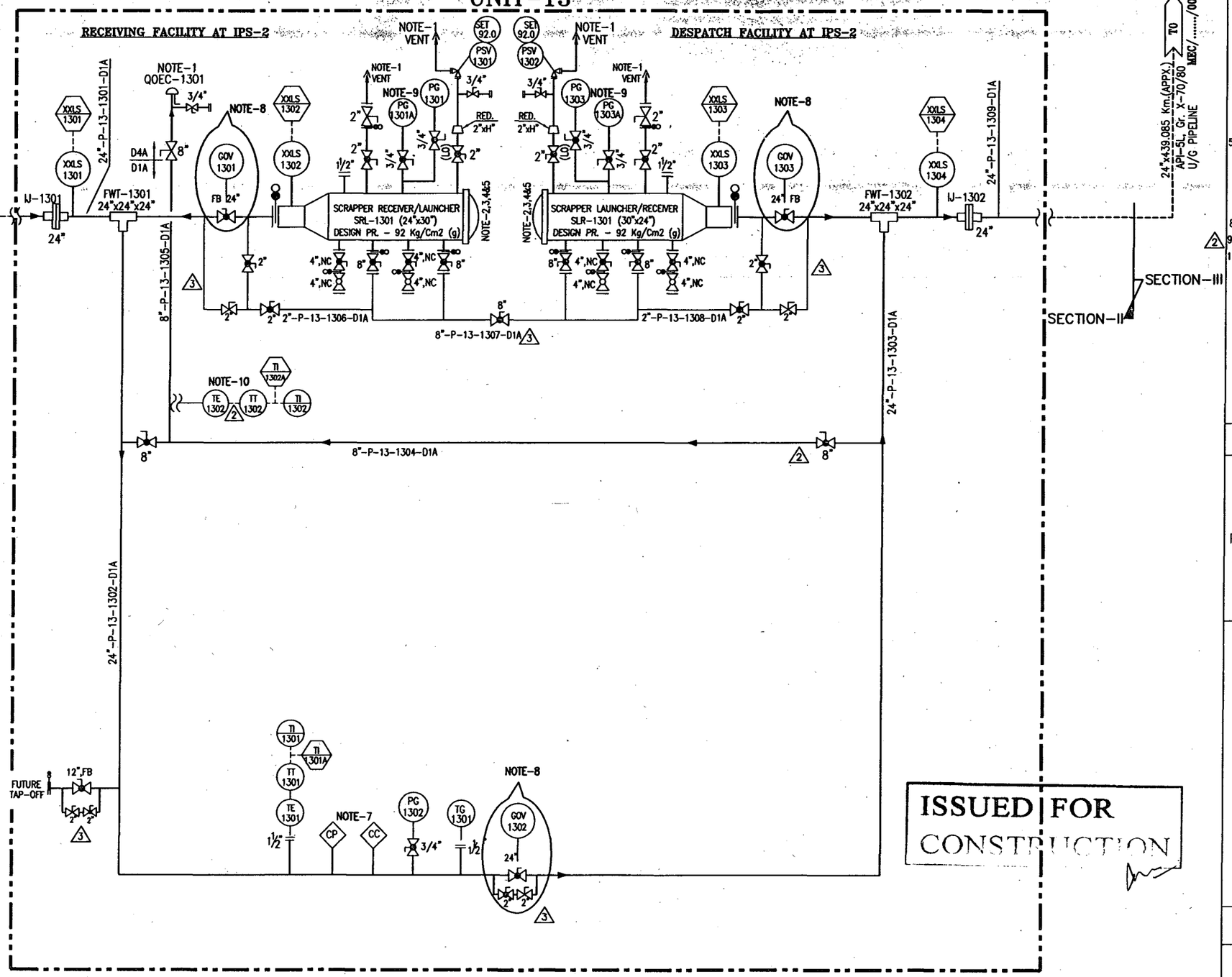
DRG. NO. MEC/23ME/05/28/M/001/0006

REV 2

REV / SEC | INST. | CONCURRED BY

DRG. NO. MEC/23ME/05/28/M/001/0007

UNIT-13



INTERMEDIATE PIGGING STATION-2
CH. 188.80 Km. (APPROX.)

ISSUED FOR CONSTRUCTION

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. SCRAPPER LAUNCHER/RECEIVER SHALL HAVE SCRAPPER HANDLING FACILITY COMPIRING OF A JIB CRANE & A TROLLY AND SHALL HAVE A QUICK OPPENING CLOSURE.
3. SCRAPPER LAUNCHER/RECEIVER SHALL BE SUITABLE FOR HANDLING INTELLIGENT PIGS.
4. DELETED.
5. SCRAPPER DOOR MECHANISM TO BE CONSTRUCTED SUCH THAT THE DOOR CAN NOT BE OPENED UNLESS SCRAPPER TRAP IS FULLY DEPRESSURISED.
6. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
7. ONLINE RETRIVEL TYPE CORROSION MONITORING COUPON AND CORROSION PROBE SHALL BE PROVIDED.
8. FOR SV & GOV DETAIL REFER DRG. NO. MEC/23ME/05/28/M/001/0023-0030
9. PG-1301 & 1303 SHALL HAVE A RANGE OF 0-1 Kg/Cm2(g) WITH A GAUGE SAVER
10. DIRECT SURFACE CONTACT TYPE.

PROCESS DATA

FLUID	: NATURAL GAS/RLNG
FLOW	: 10.557 MMSCMD (APPX.)
PRESSURE	: 61-64 KG/Cm2(G)
DESIGN	: 92 KG/Cm2(G)

TEMPERATURE	
WORKING	: 0° TO 55° C
DESIGN	: -29 TO 65°C
DESIGN CLASS	: 600#

LINE LEGEND

- PROPOSED LINE A/G
- PROPOSED LINE U/G

24"-P-13-1301-D1A
8"-P-13-1301-D1A
- 8 — MATERIAL SPEC.
- 13 — LINE NO.
- 1301 — UNIT NO.
- P — PROCESS FLUID (RLNG)
- 24 — LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED
मेकॉन लिमिटेड
MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
3	03.02.12		REVISED AS MARKED 3	AKB	GVW
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVW
1	26.05.11		GENERAL REVISION	AKB	GVW

PIPELINE NETWORK SCHEMATIC DIAGRAM — REFERENCES — MEC/23ME/05/28/M/001/0021 — DRG.NO.

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SIG (G.V.W.)
DATE	08.02.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

P & ID FOR INTERMEDIATE PIGGING STATION-2 (SECTION-II)

SCALE : NTS

DRG. NO. MEC/23ME/05/28/M/001/0007

REV 3

REV / SEC | INST. | CONCURRED BY

DRG. NO. MEC/23ME/05/28/M/001/0008

FROM MEC/...../0007

UNIT-14

SV-11
24"FB

NOTE-5,6,7,9
CH:~212.80Km.

UNIT-15

SV-12
24"FB

NOTE-5,6,7,9
CH:~236.80Km.

UNIT-16

SV-13
24"FB

NOTE-5,6,7,9
CH:~260.80Km.

UNIT-17

SV-14
24"FB

NOTE-5,6,7
CH:~284.80Km.

TO MEC/...../0009

24"x439.085 Km.(APPX.)
API-5L Gr. X-70/80 U/G PIPELINE

24"x439.085 Km.(APPX.)
API-5L Gr. X-70/80 U/G PIPELINE

ISSUED FOR CONSTRUCTION

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. NOTE DELETED.
3. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
4. ALL UNMANNED STATION SHALL BE PROVIDED WITH CO2 FLOODING SYSTEM AND ALL MANNED STATION SHALL BE WITH FM-200 FIRE SUPPRESSION SYSTEM.
5. ALL SV EXTENDED STEM BW, FULL BORE BALL VALVE.
6. BURRIED VALVE SHALL BE PROVIDED WITH CORROSION PROTECTION COATING.
7. FOR SV & GOV DETAIL REFER DRG. NO. MEC/23ME/05/28/M/001/0023-0030
8. ALL SV STATIONS & TAP-OFF CHAINAGES HAS TO BE CONFIRMED BY GAIL.
9. FOR SV-11, 12 & 13 SEE TYP. DRG. NO. MEC/23ME/05/28/M/001/0026 & MEC/23ME/05/28/M/001/0027.
10. ALL SV STATIONS WITHIN KERALA STATE, SV's HAVING FIXED CONSUMERS & SV-26, 27 (NEAR CITY) ARE CONSIDERED WITH FUTURE TAP-OFF. HOWEVER OUT OF REST NINE No. SV's FIVE No. OF THEM ARE WITH FUTURE TAP-OFF & FOUR No. ARE WITHOUT FUTURE TAP-OFF (TO BE DECIDED ON THE BASIS OF GEOGRAPHICAL LOCATION OF SV STATION).

PROCESS DATA

FLUID	: NATURAL GAS/RLNG	TEMPERATURE	
		WORKING	: 0° TO 55° C
FLOW	: 4.997 MMSCMD (APPX.)	DESIGN	: -29 TO 65°C
PRESSURE	: 51-60 KG/Cm2(G)	DESIGN CLASS	: 600#
DESIGN	: 92 KG/Cm2(G)		

LINE LEGEND

——— PROPOSED LINE A/G
— — — PROPOSED LINE U/G

24"-P-13-1301-D1A
- 24" — MATERIAL SPEC.
- P — LINE NO.
- 13 — UNIT NO.
- 1301 — PROCESS FLUID (RLNG)
- D1A — LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1 1/2" SW END.
- PLUG VALVE BW END/UPTO 1 1/2" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVW
1	28.05.11		GENERAL REVISION	AKB	GVW

REFERENCES	DRG.NO.
PIPELINE NETWORK SCHEMATIC DIAGRAM	MEC/23ME/05/28/M/001/0021

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SIG (G.V.W.)
DATE	08.02.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

P & ID FOR SV STATIONS ALONG THE PIPELINE FOR BANGALORE-MANGALORE PHASE-2 PIPELINE (SECTION-III)

SCALE : NTS

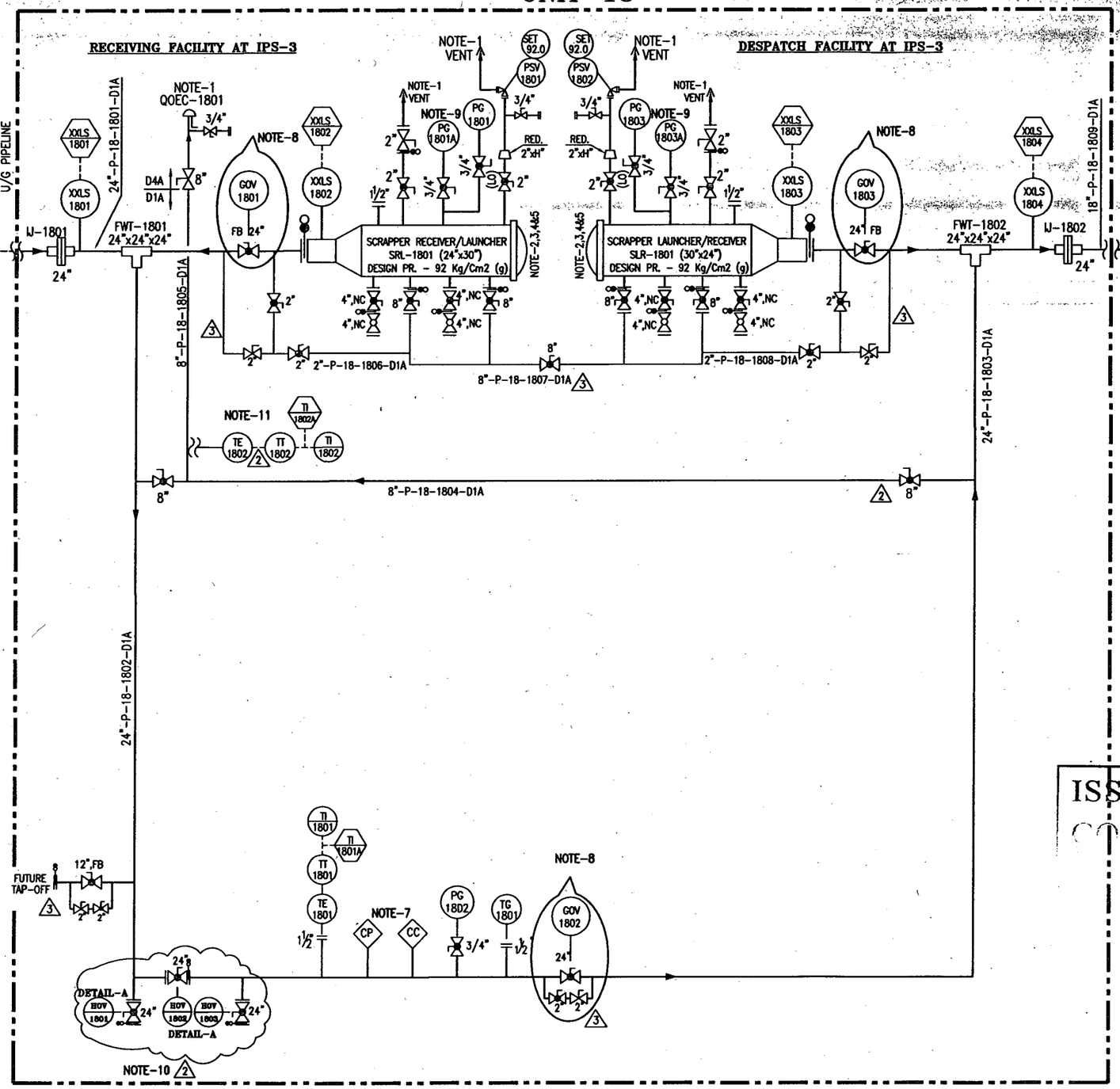
DRG. NO. MEC/23ME/05/28/M/001/0008

REV 2

REV / SEC | INST. | CONCURRED BY

DRG. NO. MEC/23ME/05/28/M/001/0009

UNIT-18



ISSUED FOR CONSTRUCTION

INTERMEDIATE PIGGING STATION-3
CH. 300.8 Km. (APPROX.)

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. SCRAPPER LAUNCHER/RECEIVER SHALL HAVE SCRAPPER HANDLING FACILITY COMPIRING OF A JIB CRANE & A TROLLY AND SHALL HAVE A QUICK OPPENING CLOSURE.
3. SCRAPPER LAUNCHER/RECEIVER SHALL BE SUITABLE FOR HANDLING INTELLIGENT PIGS.
4. DELETED.
5. SCRAPPER DOOR MECHANISM TO BE CONSTRUCTED SUCH THAT THE DOOR CAN NOT BE OPENED UNLESS SCRAPPER TRAP IS FULLY DEPRESSURISED.
6. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
7. ONLINE RETRIVEL TYPE CORROSION MONITORING COUPON AND CORROSION PROBE SHALL BE PROVIDED.
8. FOR SV & GOV DETAIL REFER DRG. NO. MEC/23ME/05/28/M/001/0023-0030
9. PG-1801 & 1803 SHALL HAVE A RANGE OF 0-1 Kg/Cm2(g) WITH A GAUGE SAVER
10. TAP-OFF PROVIDED FOR COMPRESSOR STATION IN FUTURE.
11. DIRECT SURFACE CONTACT TYPE.

PROCESS DATA

FLUID	: NATURAL GAS/RLNG	TEMPERATURE	
FLOW	: 4.997 MMSCMD (APPX.)	WORKING	: 0° TO 55° C
PRESSURE	: 48-51 KG/Cm2(G)	DESIGN	: -29 TO 65°C
DESIGN	: 92 KG/Cm2(G)	DESIGN CLASS	: 600#

LINE LEGEND

——— PROPOSED LINE A/G
– – – PROPOSED LINE U/G

24"-P-18-1801-D1A
8"-P-18-1801-D1A
- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (RLNG)
- LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED
मेकॉन लिमिटेड
MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
3	03.02.12		REVISED AS MARKED 3	AKB	GVW
2	26.06.11		AS PER GAIL'S COMMENTS	AKB	GVW
1	26.05.11		GENERAL REVISION	AKB	GVW

PIPELINE NETWORK SCHEMATIC DIAGRAM — MEC/23ME/05/28/M/001/0021

REFERENCES — DRG.NO.

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SIG (G.V.W.)
DATE	08.02.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

P & ID FOR INTERMEDIATE PIGGING STATION-3 (SECTION-III)

SCALE : NTS

DRG. NO. MEC/23ME/05/28/M/001/0009 — REV 3

REV / SEC — INST. — CONCURRED BY

DRG. NO. MEC/23ME/05/28/M/001/0010

FROM MEC/...../0009

UNIT-19 | UNIT-20 | UNIT-21 | UNIT-22 | UNIT-23

SV-15 24"FB — NOTE-5,6,7,9 CH:~316.80Km.

SV-16 24"FB — NOTE-5,6,7 CH:~332.80Km.

SV-17 24"FB — NOTE-5,6,7 CH:~348.80Km.

SV-18 24"FB — NOTE-5,6,7,10 CH:~364.80Km.

SV-19 24"FB — NOTE-5,6,7,10 CH:~380.80Km.

TO MEC/...../0011

24"x439.085 Km.(APPX.) API-5L, Gr. X-70/80 U/G PIPELINE

24"x439.085 Km.(APPX.) API-5L, Gr. X-70/80 U/G PIPELINE

SECTION-III

SECTION-IV

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. NOTE DELETED.
3. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
4. ALL UNMANNED STATION SHALL BE PROVIDED WITH CO2 FLOODING SYSTEM AND ALL MANNED STATION SHALL BE WITH FM-200 FIRE SUPPRESSION SYSTEM.
5. ALL SV EXTENDED STEM BW, FULL BORE BALL VALVE.
6. BURRIED VALVE SHALL BE PROVIDED WITH CORROSION PROTECTION COATING.
7. FOR SV & GOV DETAIL REFER DRG. NO. MEC/23ME/05/28/M/001/0023-0030
8. ALL SV STATIONS & TAP-OFF CHAINAGES HAS TO BE CONFIRMED BY GAIL.
9. FOR SV-15 SEE TYP. DRG. NO. MEC/23ME/05/28/M/001/0026.
10. SV-18 & 19 FUTURE TAP-OFF SHALL BE USED FOR JSW STEEL & SALEM STEEL PLANT RESPECTIVELY.
11. FOR SV-18 & 19 SEE TYP. DRG. NO. MEC/23ME/05/28/M/001/0030
12. ALL SV STATIONS WITHIN KERALA STATE, SV's HAVING FIXED CONSUMERS & SV-26, 27 (NEAR CITY) ARE CONSIDERED WITH FUTURE TAP-OFF. HOWEVER OUT OF REST NINE No. SV's FIVE No. OF THEM ARE WITH FUTURE TAP-OFF & FOUR No. ARE WITHOUT FUTURE TAP-OFF (TO BE DECIDED ON THE BASIS OF GEOGRAPHICAL LOCATION OF SV STATION).

PROCESS DATA

FLUID	: NATURAL GAS/RLNG
FLOW	: 2.66 MMSCMD (APPX.)
PRESSURE	: 46-48 KG/Cm2(G)
DESIGN	: 92 KG/Cm2(G)

TEMPERATURE
WORKING : 0° TO 55° C
DESIGN : -29 TO 65°C
DESIGN CLASS : 600#

LINE LEGEND

——— PROPOSED LINE A/G
— — — PROPOSED LINE U/G

24"-P-18-1801-D1A
- 24" — LINE SIZE (NOMINAL)
- P — PROCESS FLUID (RLNG)
- 18 — UNIT NO.
- 1801 — LINE NO.
- D1A — MATERIAL SPEC.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

ISSUED FOR CONSTRUCTION

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED
मेकॉन लिमिटेड
MECON LIMITED

REV.NO	DATE	ZONE	DESCRIPTION	BY	VERIFIED
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVM
1	28.05.11		GENERAL REVISION	AKB	GVM

REFERENCES: PIPELINE NETWORK SCHEMATIC DIAGRAM — DRG.NO. MEC/23ME/05/28/M/001/0021

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVM
APPROVED	SIG (G.V.M.)
DATE	08.02.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

P & ID FOR SV STATIONS ALONG THE PIPELINE FOR BANGALORE-MANGALORE PHASE-2 PIPELINE (SECTION - III & IV)

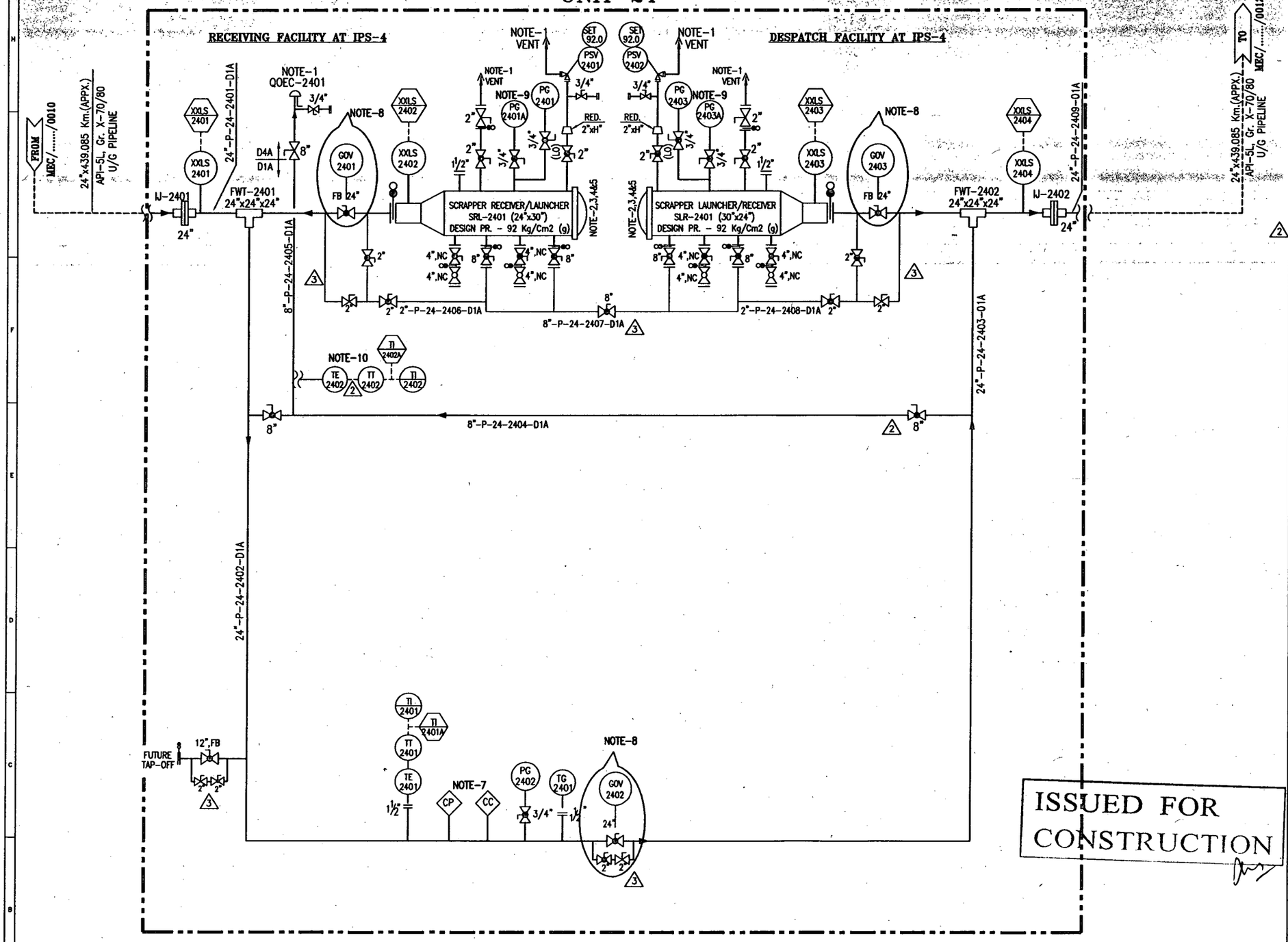
SCALE : NTS | REV 2

DRG. NO. MEC/23ME/05/28/M/001/0010

REV / SEC | INST. | CONCURRED BY

DRG. NO. MEC/23ME/05/28/M/001/0011

UNIT-24



INTERMEDIATE PIGGING STATION-4
CH. 396.8 Km. (APPROX.)

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. SCRAPPER LAUNCHER/RECEIVER SHALL HAVE SCRAPPER HANDLING FACILITY COMPIRING OF A JIB CRANE & A TROLLY AND SHALL HAVE A QUICK OPPENING CLOSURE.
3. SCRAPPER LAUNCHER/RECEIVER SHALL BE SUITABLE FOR HANDLING INTELLIGENT PIGS.
4. DELETED.
5. SCRAPPER DOOR MECHANISM TO BE CONSTRUCTED SUCH THAT THE DOOR CAN NOT BE OPENED UNLESS SCRAPPER TRAP IS FULLY DEPRESSURISED.
6. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
7. ONLINE RETRIVEL TYPE CORROSION MONITORING COUPON AND CORROSION PROBE SHALL BE PROVIDED.
8. FOR SV & GOV DETAIL REFER DRG. NO. MEC/23ME/05/28/M/001/0023-0030
2 9. PG-2401 & 2403 SHALL HAVE A RANGE OF 0-1 Kg/Cm2(g) WITH A GAUGE SAVER
10. DIRECT SURFACE CONTACT TYPE.

PROCESS DATA

FLUID : NATURAL GAS/RLNG	TEMPERATURE
FLOW : 2.3 MMSCMD (APPX.)	WORKING : 0° TO 55° C
PRESSURE : 46-48 KG/Cm2(G)	DESIGN : -29 TO 65°C
DESIGN : 92 KG/Cm2(G)	DESIGN CLASS : 600#

LINE LEGEND

PROPOSED LINE A/G
PROPOSED LINE U/G

24"-P-24-2401-D1A
8"-P-24-2401-D1A
- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (RLNG)
- LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

ISSUED FOR CONSTRUCTION

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED
मेकॉन लिमिटेड
MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
3	03.02.12		REVISED AS MARKED 3	AKB	GVW
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVW
1	26.05.11		GENERAL REVISION	AKB	GVW

REFERENCES: PIPELINE NETWORK SCHEMATIC DIAGRAM — DRG.NO. MEC/23ME/05/28/M/001/0021

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SIG (G.V.W.)
	DATE 08.02.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

P & ID FOR INTERMEDIATE PIGGING STATION-4 (SECTION-IV)

SCALE : NTS

DRG. NO. MEC/23ME/05/28/M/001/0011

REV 3

REV / SEC | INST. | CONCURRED BY

DRG. NO. MEC/23ME/05/28/M/001/0012

FROM MEC/...../0011

UNIT-25

UNIT-26

UNIT-27

UNIT-28

UNIT-29

SV-20 24"FB

SV-21 24"FB

SV-22 24"FB

SV-23 24"FB

SV-24 24"FB

NOTE-5,6,7 CH:~412.80Km.

NOTE-5,6,7 CH:~428.80Km.

NOTE-5,6,7 CH:~448.80Km.

NOTE-5,6,7 CH:~460.80Km.

NOTE-5,6,7 CH:~476.80Km.

24"x439.085 Km.(APPX.) API-5L, Gr. X-70/80 U/G PIPELINE

SECTION-IV

SECTION-V

24"x439.085 Km.(APPX.) API-5L, Gr. X-70/80 U/G PIPELINE

TO MEC/...../0013

ISSUED FOR CONSTRUCTION

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. NOTE DELETED.
3. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
4. ALL UNMANNED STATION SHALL BE PROVIDED WITH CO2 FLOODING SYSTEM AND ALL MANNED STATION SHALL BE WITH FM-200 FIRE SUPPRESSION SYSTEM.
5. ALL SV EXTENDED STEM BW, FULL BORE BALL VALVE.
6. BURRIED VALVE SHALL BE PROVIDED WITH CORROSION PROTECTION COATING.
7. FOR SV & GOV DETAIL REFER DRG. NO. MEC/23ME/05/28/M/001/0023-0030
8. ALL SV STATIONS & TAP-OFF CHAINAGES HAS TO BE CONFIRMED BY GAIL.
9. ALL SV STATIONS WITHIN KERALA STATE, SV's HAVING FIXED CONSUMERS &
10. ALL SV STATIONS WITHIN KERALA STATE, SV's HAVING FIXED CONSUMERS & SV-26, 27 (NEAR CITY) ARE CONSIDERED WITH FUTURE TAP-OFF. HOWEVER OUT OF REST NINE No. SV's FIVE No. OF THEM ARE WITH FUTURE TAP-OFF & FOUR No. ARE WITHOUT FUTURE TAP-OFF (TO BE DECIDED ON THE BASIS OF GEOGRAPHICAL LOCATION OF SV STATION).

PROCESS DATA

FLUID : NATURAL GAS/RLNG	TEMPERATURE
FLOW : 2.3 MMSCMD (APPX.)	WORKING : 0° TO 55° C
PRESSURE : 45-48 KG/Cm2(G)	DESIGN : -29 TO 65°C
DESIGN : 92 KG/Cm2(G)	DESIGN CLASS : 600#

LINE LEGEND

——— PROPOSED LINE A/G

— — — PROPOSED LINE U/G

24"-P-24-2401-D1A
- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (RLNG)
- LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1 1/2" SW END.
- PLUG VALVE BW END/UPTO 1 1/2" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVW
1	26.05.11		GENERAL REVISION	AKB	GVW

REV / SEC | INST. | CONCURRED BY

PIPELINE NETWORK SCHEMATIC DIAGRAM: MEC/23ME/05/28/M/001/0021

REFERENCES | DRG.NO.

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SIG (G.V.W.)
DATE	08.02.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

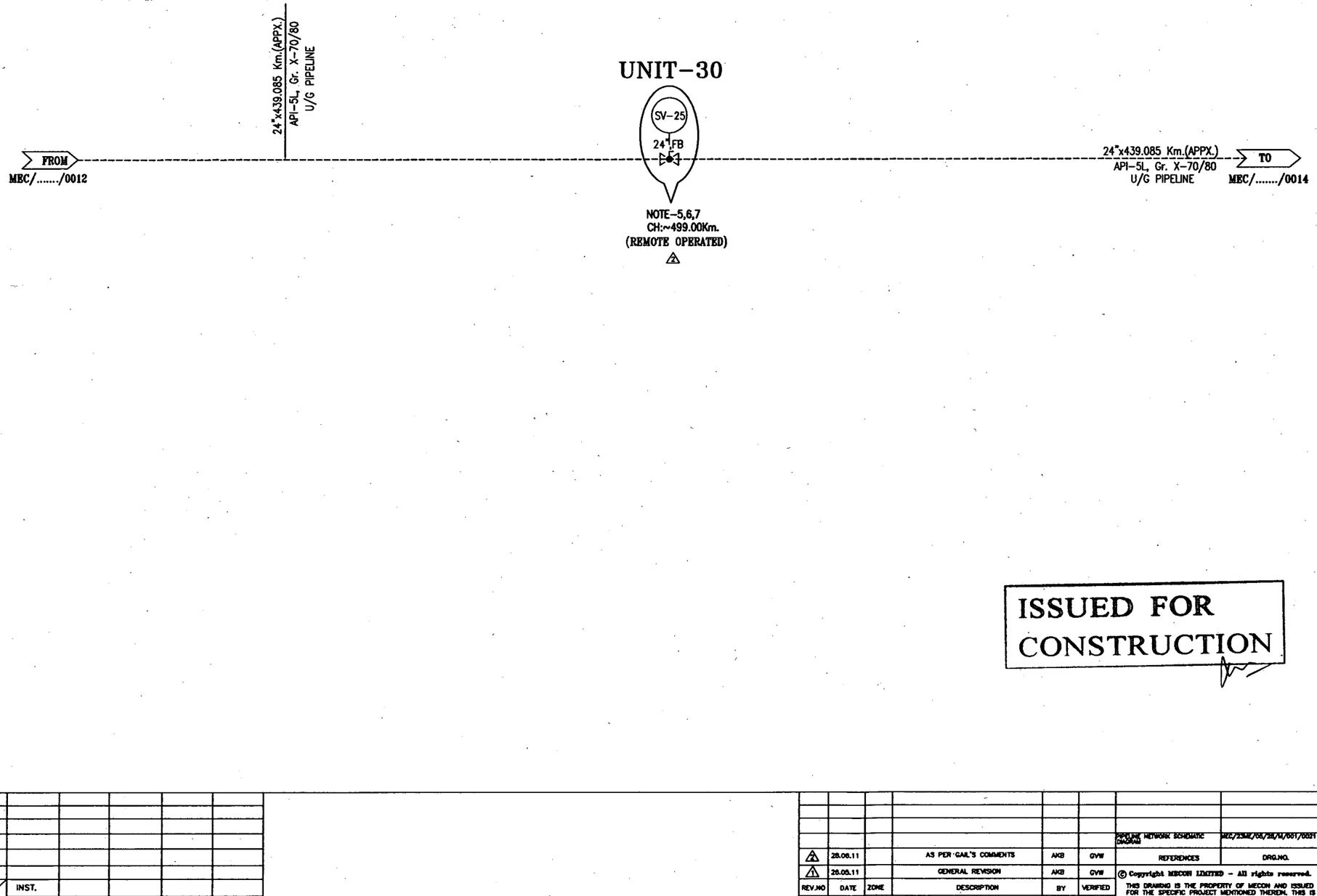
P & ID FOR SV STATIONS ALONG THE PIPELINE FOR BANGALORE-MANGALORE PHASE-2 PIPELINE (SECTION - IV & V)

SCALE : NTS

DRG. NO. MEC/23ME/05/28/M/001/0012

REV 2

DRG. NO. MEC/23ME/05/28/M/001/0013



NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. NOTE DELETED.
3. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
4. ALL UNMANNED STATION SHALL BE PROVIDED WITH CO2 FLOODING SYSTEM AND ALL MANNED STATION SHALL BE WITH FM-200 FIRE SUPPRESSION SYSTEM.
5. ALL SV EXTENDED STEM BW, FULL BORE BALL VALVE.
6. BURRIED VALVE SHALL BE PROVIDED WITH CORROSION PROTECTION COATING.
7. FOR SV & GOV DETAIL REFER DRG. NO. MEC/23ME/05/28/M/001/0023-0030
8. ALL SV STATIONS & TAP-OFF CHAINAGES HAS TO BE CONFIRMED BY GAIL.
9. ALL SV STATIONS WITHIN KERALA STATE, SV's HAVING FIXED CONSUMERS & SV-26, 27 (NEAR CITY) ARE CONSIDERED WITH FUTURE TAP-OFF. HOWEVER OUT OF REST NINE No. SV's FIVE No. OF THEM ARE WITH FUTURE TAP-OFF & FOUR No. ARE WITHOUT FUTURE TAP-OFF (TO BE DECIDED ON THE BASIS OF GEOGRAPHICAL LOCATION OF SV STATION).

PROCESS DATA

FLUID : NATURAL GAS/RLNG	TEMPERATURE
FLOW : 2.3 MMSCMD (APPX.)	WORKING : 0° TO 55° C
PRESSURE : 45-48 KG/Cm2(G)	DESIGN : -29 TO 65°C
DESIGN : 92 KG/Cm2(G)	DESIGN CLASS : 600#

LINE LEGEND

——— PROPOSED LINE A/G
— — — PROPOSED LINE U/G

24"-P-30-3001-D1A
8"-P-30-3001-D1A

- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (RLNG)
- LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

ISSUED FOR CONSTRUCTION

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED
मेकॉन लिमिटेड
MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVM
1	26.05.11		GENERAL REVISION	AKB	GVM

PIPELINE NETWORK SCHEMATIC DIAGRAM — MEC/23ME/05/28/M/001/0021

REFERENCES — DRG.NO.

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVM
APPROVED	SIG (G.V.M.)
	DATE 08.02.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

P & ID FOR SV STATIONS ALONG THE PIPELINE FOR BANGALORE-MANGALORE PHASE-2 PIPELINE (SECTION-V)

SCALE : NTS

DRG. NO. MEC/23ME/05/28/M/001/0013 — REV 2

REV / SEC | INST. | CONCURRED BY

DRG. NO. MEC/23ME/05/28/M/001/0014

UNIT-33

UNIT-31

UNIT-32

FROM MEC/...../0013

24"x439.085 Km.(APPX.)
API-5L, Gr. X-70/80
U/G PIPELINE

FWT-3302 (24"x24"x24")

TAP-OFF POINT FOR KPCL BIDADI CH -507.00 Km.

SV-26 24"FB

NOTE-8,9,10,14 CH:~514.00Km.

SV-27 24"FB

NOTE-8,9,10,14 CH:~522.00Km.

IJ-3301 24"

FWT-3301 24"x24"x24"

24"-P-33-3301-D1A

NOTE-1 QOEC-3301

D4A D1A

NOTE-10

GOV 3301 24"FB

XXLS 3301

XXLS 3302

NOTE-1

PSV 3301 SET 92.0

PG 3301A

PG 3301

NOTE-12

RED. 2"xH"

SCRAPPER RECEIVER/LAUNCHER DESIGN PR. - 92 Kg/Cm2 (g) SRL-3301 (24"x30")

NOTE-2,3,4&5

PIG HANDLING DEVICE

2"-P-33-3304-D1A

8"-P-33-3304-D1A

TE 3302 TT 3302 TI 3302 TI 3302A

NOTE-13

GOV 3302 24"

NOTE-10

8"-P-33-3303-D1A

24"-P-33-3302-D1A

TG 3301 PG 3302 TE 3301 TT 3301 TI 3301 TI 3301A

CP CC

NOTE-7

METERING SKID

DETAIL-B

NOTE-17

18" DABHOL BANGALORE P/L

RECEIVING FACILITY AT BANGLORE (SINGASANDRA) (CH. ~529.7 KM.)

KKBM P/L (PHASE-2)

METERING SKID FOR INTERCONNECTION OF DABHOL-BANGALORE PIPELINE WITH KKBMPL PH-II PIPELINE

DETAIL-B 3

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST LEVEL.
2. SCRAPPER LAUNCHER/RECEIVER SHALL HAVE SCRAPPER HANDLING FACILITY COMPIRING OF A JIB CRANE & A TROLLY AND SHALL HAVE A QUICK OPPENING CLOSURE.
3. SCRAPPER LAUNCHER/RECEIVER SHALL BE SUITABLE FOR HANDLING INTELLIGENT PIGS.
4. DELETED.
5. SCRAPPER DOOR MECHANISM TO BE CONSTRUCTED SUCH THAT THE DOOR CAN NOT BE OPENED UNLESS SCRAPPER TRAP IS FULLY DEPRESSURISED.
6. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
7. ONLINE RETRIVEL TYPE CORROSION MONITORING COUPON AND CORROSION PROBE SHALL BE PROVIDED.
8. ALL SV EXTENDED STEM BW, FULL BORE BALL VALVE.
9. BURRIED VALVE SHALL BE PROVIDED WITH CORROSION PROTECTION COATING.
10. FOR SV & GOV DETAIL REFER DRG. NO. MEC/23ME/05/28/M/001/0023-0030
11. ALL SV STATIONS & TAP-OFF CHAINAGES HAS TO BE CONFIRMED BY GAIL.
12. PG-3301 SHALL HAVE A RANGE OF 0-1 Kg/Cm2(g) WITH A GAUGE SAVER.
13. DIRECT SURFACE CONTACT TYPE.
14. SV-26 & 27 BOTH ARE MANUALLY OPERATED.
15. ALL SV STATIONS WITHIN KERALA STATE, SV's HAVING FIXED CONSUMERS & SV-26, 27 (NEAR CITY) ARE CONSIDERED WITH FUTURE TAP-OFF. HOWEVER OUT OF REST NINE No. SV's FIVE No. OF THEM ARE WITH FUTURE TAP-OFF & FOUR No. ARE WITHOUT FUTURE TAP-OFF (TO BE DECIDED ON THE BASIS OF GEOGRAPHICAL LOCATION OF SV STATION).
16. EIL WILL PROVIDE TAP-OFF WITH BALL VALVE ALONG WITH BLIND FLANGE.
17. FOR INTERCONNECTION OF KKBMPL (PHASE-2) WITH DABHOL-BANGALORE P/L SEE "DETAIL-B".

PROCESS DATA

FLUID	: NATURAL GAS/RLNG
FLOW	: 2.3 MMSCMD (APPX.)
PRESSURE	: 45-47 KG/Cm2(G)
DESIGN	: 92 KG/Cm2(G)

TEMPERATURE
WORKING : 0° TO 55°C
DESIGN : -29 TO 65°C
DESIGN CLASS : 600#

LINE LEGEND
- PROPOSED LINE A/G
- PROPOSED LINE U/G
- EXISTING LINE U/G (EIL)
- EXISTING LINE A/G (EIL)

24"-P-33-3301-D1A
B"-P-33-3301-D1A
- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (RLNG)
- LINE SIZE (NOMINAL)

VALVE LEGEND
- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

PRELIMINARY DRAWING

ISSUED FOR CONSTRUCTION

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

REV	DATE	ZONE	DESCRIPTION / REVISION	BY	VERIFIED
3	03.02.12		REVISED AS MARKED 3	AKB	GVW
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVW
1	28.05.11		GENERAL REVISION	AKB	GVW

PIPELINE NETWORK SCHEMATIC DIAGRAM — REFERENCES — MEC/23ME/05/28/M/001/0021 — DRG.NO.

© Copyright MECON LIMITED - All rights reserved. THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

REV	INST.
SEC	CONCURRED BY

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SIG (G.V.W.)
	DATE 08.02.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

P&ID FOR RECEIVING TERMINAL AT BANGALORE (CH. 529.70 Km.) (SECTION-V)

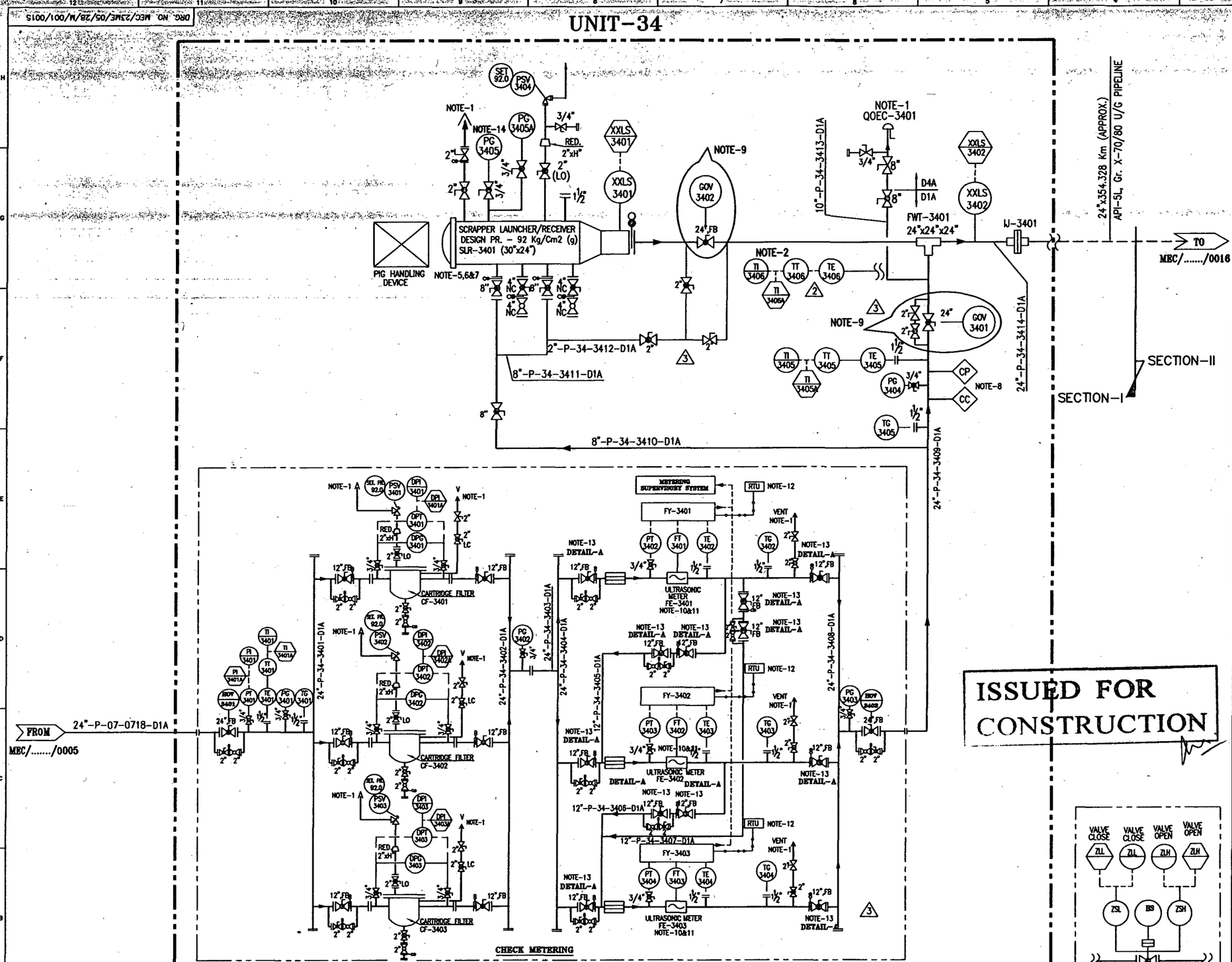
SCALE : NTS

DRG. NO. MEC/23ME/05/28/M/001/0014

REV 3

DRG. NO. MEC/23ME/05/28/M/001/0015

UNIT-34



DESPATCH FACILITY AT IP-1 (OF PHASE-2 P/L) FOR MANGALORE SPURLINE

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. DIRECT SURFACE CONTACT TYPE.
3. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
4. ALL UNMANNED STATION SHALL BE PROVIDED WITH CO2 FLOODING SYSTEM AND ALL MANNED STATION SHALL BE WITH FM-200 FIRE SUPPRESSION SYSTEM.
5. SCRAPPER TRAP SHALL HAVE FEATURE FOR WORKING AS LAUNCHER AS WELL AS RECEIVER i.e. BI-DIRECTIONAL.
6. SCRAPPER LAUNCHER / RECEIVER SHALL BE SUIATABLE FOR HANDLING INTELLIGENT PIGS.
7. SCRAPPER DOOR MECHANISM TO BE CONSTRUCTED SUCH THAT THE DOOR CAN NOT BE OPENED UNLESS SCRAPPER TRAP IS FULLY DEPRESSURISED.
8. ONLINE RETRIVEL TYPE CORROSION MONITORING COUPON AND CORROSION PROBE SHALL BE PROVIDED.
9. FOR SV & GOV DETAIL REFER DRG. NO. MEC/23ME/05/28/M/001/0023-0030
10. METERING SHALL BE DONE BY ULTRASONIC FLOW METER WITH CONTROL PANEL MOUNTED FLOW COMPUTER. INSTALLATION SHALL BE AS PER AGA9 LATEST EDITION. HOWEVER THERE SHALL BE THREE STREAMS OF METERING (2W+1S).
11. ENVIRONMENTAL ENCLOSURE REQUIRED FOR METERING INSTRUMENTS. INSULATION OF USM METER RUN & IMPLUSE LINES OF METERING INSTRUMENT IS REQUIRED.
12. PROVISION SHALL BE KEPT TO HOOK UP METERING PR. & TEMP., FLOW PARAMETERS WITH SCADA.
13. THESE VALVES ACROSS THE USM SHALL BE PROVIDED WITH LIMIT SWITCHES.
14. PG-3405 SHALL HAVE A RANGE OF 0-1 Kg/Cm2(g) WITH A GAUGE SAVER.

PROCESS DATA

FLUID	: NATURAL GAS/RLNG	TEMPERATURE WORKING	: 0°-55° C
FLOW	: 7.053 MMSCMD (APPX.)	DESIGN	: -29 TO 65°C
PRESSURE	: 75-78 KG/Cm2(G)	DESIGN CLASS	: 600#
DESIGN	: 92 KG/Cm2(G)		

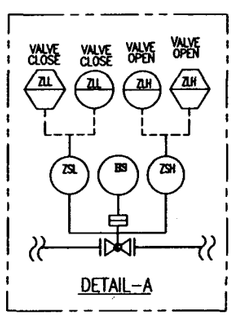
LINE LEGEND

PROPOSED LINE A/G
PROPOSED LINE U/G

24"-P-34-3401-D1A
8"-P-34-3401-D1A
- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (RLNG)
- LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.



DETAIL-A

ISSUED FOR CONSTRUCTION

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED
मेकॉन लिमिटेड
MECON LIMITED

REV	DATE	ZONE	REVISION	BY	VERIFIED
3	03.02.12		REVISED AS MARKED 3	AKB	GVM
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVM
1	28.05.11		GENERAL REVISION	AKB	GVM

PIPELINE NETWORK SCHEMATIC DRAWING — REFERENCES — DRG.NO. MEC/23ME/05/28/M/001/0021

© Copyright MECON LIMITED - All rights reserved. THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS	KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)	
LOCATION	DELHI		
DESIGNED	AKB		
DRAWN	SUNIL	P & ID FOR DESPATCH FACILITY AT IP-1 OF PHASE-2, FOR MANGALORE SPURLINE (SECTION-I)	
CHECKED AND VERIFIED	GVM		
APPROVED	SKG (G.V.M.)	SCALE : NTS	REV
DATE	08.02.2011	DRG. NO. MEC/23ME/05/28/M/001/0015	3

REV / SEC | INST. | CONCURRED BY

DRG NO. MEC/23ME/05/28/M/001/0016

FROM MEC/...../0015

UNIT-35

SV-1(M)
24"FB

NOTE-5,6,7
CH:~15.900Km.

UNIT-36

SV-2(M)
24"FB

NOTE-5,6,7,9
CH:~31.455Km.

UNIT-37

SV-3(M)
24"FB

NOTE-5,6,7
CH:~46.008Km.

UNIT-38

SV-4(M)
24"FB

NOTE-5,6,7
CH:~63.739Km.

UNIT-39

SV-5(M)
24"FB

NOTE-5,6,7
CH:~80.859Km.

TO MEC/...../0017

24"x354.328 Km (APPROX.)
API-5L, Gr. X-70/80 U/G PIPELINE

SECTION-II

SECTION-VI

ISSUED FOR CONSTRUCTION

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. NOTE DELETED.
3. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
4. ALL UNMANNED STATION SHALL BE PROVIDED WITH CO2 FLOODING SYSTEM AND ALL MANNED STATION SHALL BE WITH FM-200 FIRE SUPPRESSION SYSTEM.
5. ALL SV EXTENDED STEM BW, FULL BORE BALL VALVE.
6. BURRIED VALVE SHALL BE PROVIDED WITH CORROSION PROTECTION COATING.
7. FOR SV & GOV DETAIL REFER DRG. NO. MEC/23ME/05/28/M/001/0023-0030
8. ALL SV STATIONS & TAP-OFF CHAINAGES HAS TO BE CONFIRMED BY GAIL.
9. FOR SV-2(M) SEE TYP. DRG. NO. MEC/23ME/05/28/M/001/0029.
10. ALL SV STATIONS ALONG MANGALORE LINE ARE CONSIDERED WITH FUTURE TAP-OFF.

PROCESS DATA

FLUID	: NATURAL GAS/RLNG	TEMPERATURE WORKING	: 0°-55° C
FLOW	: 7.04 MMSCMD (APPX.)	DESIGN	: -29 TO 65°C
PRESSURE	: 70-76 KG/Cm2(G)	DESIGN CLASS	: 600#
DESIGN	: 92 KG/Cm2(G)		

LINE LEGEND

——— PROPOSED LINE A/G
– – – PROPOSED LINE U/G

24"-P-34-3401-D1A
- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (RLNG)
- LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

REV	DATE	ZONE	DESCRIPTION / REVISION	BY	VERIFIED
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVW
1	28.05.11		GENERAL REVISION	AKB	GVW

INST.
SEC
CONCURRED BY

PIPELINE NETWORK SCHEMATIC DIAGRAM — REFERENCES — DRG.NO. MEC/23ME/05/28/M/001/0021

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREON. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SIG (G.V.W.)
DATE	08.02.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

P & ID FOR SV STATIONS ALONG THE PIPELINE FOR BANGALORE-MANGALORE PHASE-2 PIPELINE (SECTION - II & VI)

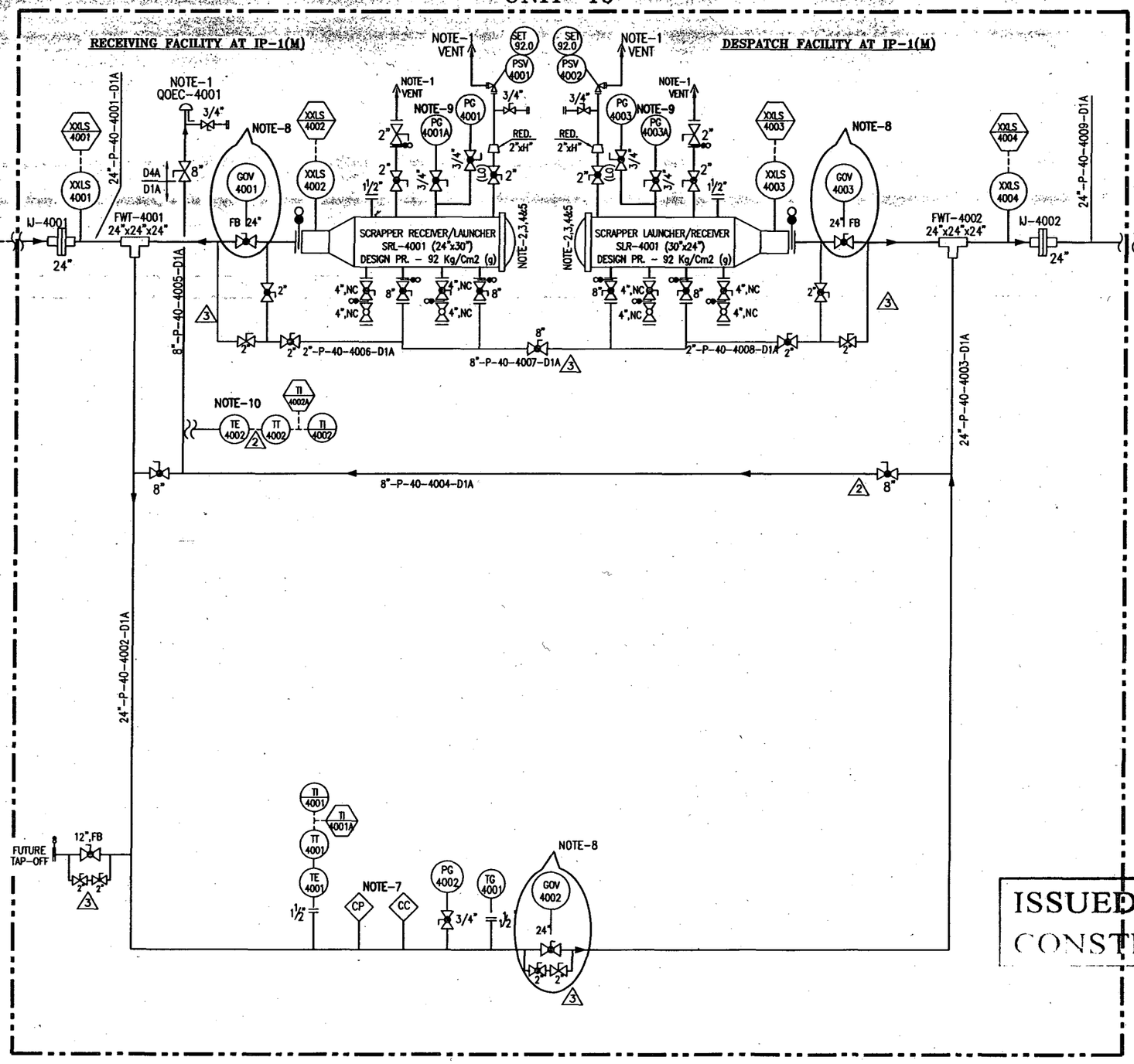
SCALE : NTS

DRG. NO. MEC/23ME/05/28/M/001/0016

REV 2

ORG. NO. MEC/23ME/05/28/M/001/0017

UNIT-40



ISSUED FOR CONSTRUCTION

INTERMEDIATE PIGGING STATION-1(M)
CH. 96.423 Km. (APPROX.)

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. SCRAPPER LAUNCHER/RECEIVER SHALL HAVE SCRAPPER HANDLING FACILITY COMPIRING OF A JIB CRANE & A TROLLY AND SHALL HAVE A QUICK OPPENING CLOSURE.
3. SCRAPPER LAUNCHER/RECEIVER SHALL BE SUITABLE FOR HANDLING INTELLIGENT PIGS.
4. DELETED.
5. SCRAPPER DOOR MECHANISM TO BE CONSTRUCTED SUCH THAT THE DOOR CAN NOT BE OPENED UNLESS SCRAPPER TRAP IS FULLY DEPRESSURISED.
6. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
7. ONLINE RETRIVEL TYPE CORROSION MONITORING COUPON AND CORROSION PROBE SHALL BE PROVIDED.
8. FOR SV & GOV DETAIL REFER DRG. NO. MEC/23ME/05/28/M/001/0023-0030
9. PG-4001 & 4003 SHALL HAVE A RANGE OF 0-1 Kg/Cm2(g) WITH A GAUGE SAVER
10. DIRECT SURFACE CONTACT TYPE.

PROCESS DATA

FLUID	: NATURAL GAS/RLNG	TEMPERATURE WORKING	: 0° TO 55° C
FLOW	: 7.04 MMSCMD (APPX.)	DESIGN	: -29 TO 65°C
PRESSURE	: 68-70 KG/Cm2(G)	DESIGN CLASS	: 600#
DESIGN	: 92 KG/Cm2(G)		

LINE LEGEND

PROPOSED LINE A/G
PROPOSED LINE U/G

24"-P-40-4001-D1A
8"-P-40-4001-D1A
- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (RLNG)
- LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED
मेकॉन लिमिटेड
MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
3	03.02.12		REVISED AS MARKED 3	AKB	GVW
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVW
1	28.05.11		GENERAL REVISION	AKB	GVW

PIPELINE NETWORK SCHEMATIC DIAGRAM — REFERENCES — MEC/23ME/05/28/M/001/0021 — DRG.NO.

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SIG (G.V.W.)
DATE	08.02.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

P & ID FOR INTERMEDIATE PIGGING STATION IP-1(M) (SECTION-VI)

SCALE : NTS | REV 3

DRG. NO. MEC/23ME/05/28/M/001/0017

REV / SEC | INST. | CONCURRED BY

DRG. NO. MEC/23ME/05/28/M/001/0018

FROM MEC/...../0017

UNIT-41

SV-6(M)

24" FB

NOTE-5,6,7
CH:~111.256Km.

UNIT-42

SV-7(M)

24" FB

NOTE-5,6,7
CH:~131.008Km.

UNIT-43

SV-8(M)

24" FB

NOTE-5,6,7
CH:~148.303Km.

UNIT-44

SV-9(M)

24" FB

NOTE-5,6,7
CH:~162.424Km.

UNIT-45

SV-10(M)

24" FB

NOTE-5,6,7,9
CH:~178.507Km.

TO MEC/...../0019

24"x354.328 Km (APPROX.) API-5L, Gr. X-70/80 U/G PIPELINE

SECTION-VII

SECTION-VI

24"x354.328 Km (APPROX.) API-5L, Gr. X-70/80 U/G PIPELINE

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. NOTE DELETED.
3. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
4. ALL UNMANNED STATION SHALL BE PROVIDED WITH CO2 FLOODING SYSTEM AND ALL MANNED STATION SHALL BE WITH FM-200 FIRE SUPPRESSION SYSTEM.
5. ALL SV EXTENDED STEM BW, FULL BORE BALL VALVE.
6. BURRIED VALVE SHALL BE PROVIDED WITH CORROSION PROTECTION COATING.
7. FOR SV & GOV DETAIL REFER DRG. NO. MEC/23ME/05/28/M/001/0023-0030
8. ALL SV STATIONS & TAP-OFF CHAINAGES HAS TO BE CONFIRMED BY GAIL.
9. FOR SV-10(M) SEE TYP. DRG. NO. MEC/23ME/05/28/M/001/0029.
10. ALL SV STATIONS ALONG MANGALORE LINE ARE CONSIDERED WITH FUTURE TAP-OFF.

PROCESS DATA

FLUID	: NATURAL GAS/RLNG	TEMPERATURE WORKING	: 0° TO 55° C
FLOW	: 6.88 MMSCMD (APPX.)	DESIGN	: -29 TO 65°C
PRESSURE	: 63-68 KG/Cm2(G)	DESIGN CLASS	: 600#
DESIGN	: 92 KG/Cm2(G)		

LINE LEGEND

——— PROPOSED LINE A/G
— — — PROPOSED LINE U/G

24"-P-40-4001-D1A
- 24" — LINE SIZE (NOMINAL)
- P — PROCESS FLUID (RLNG)
- 40 — UNIT NO.
- 4001 — LINE NO.
- D1A — MATERIAL SPEC.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

ISSUED FOR CONSTRUCTION

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVW
1	28.05.11		GENERAL REVISION	AKB	GVW

REFERENCES	DRG.NO.
PIPELINE NETWORK SCHEMATIC DIAGRAM	MEC/23ME/05/28/M/001/0021

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SIG (G.V.W.)
	DATE 05.02.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

P & ID FOR SV STATIONS ALONG THE PIPELINE FOR BANGALORE-MANGALORE PHASE-2 PIPELINE (SECTION - VI & VII)

SCALE : NTS

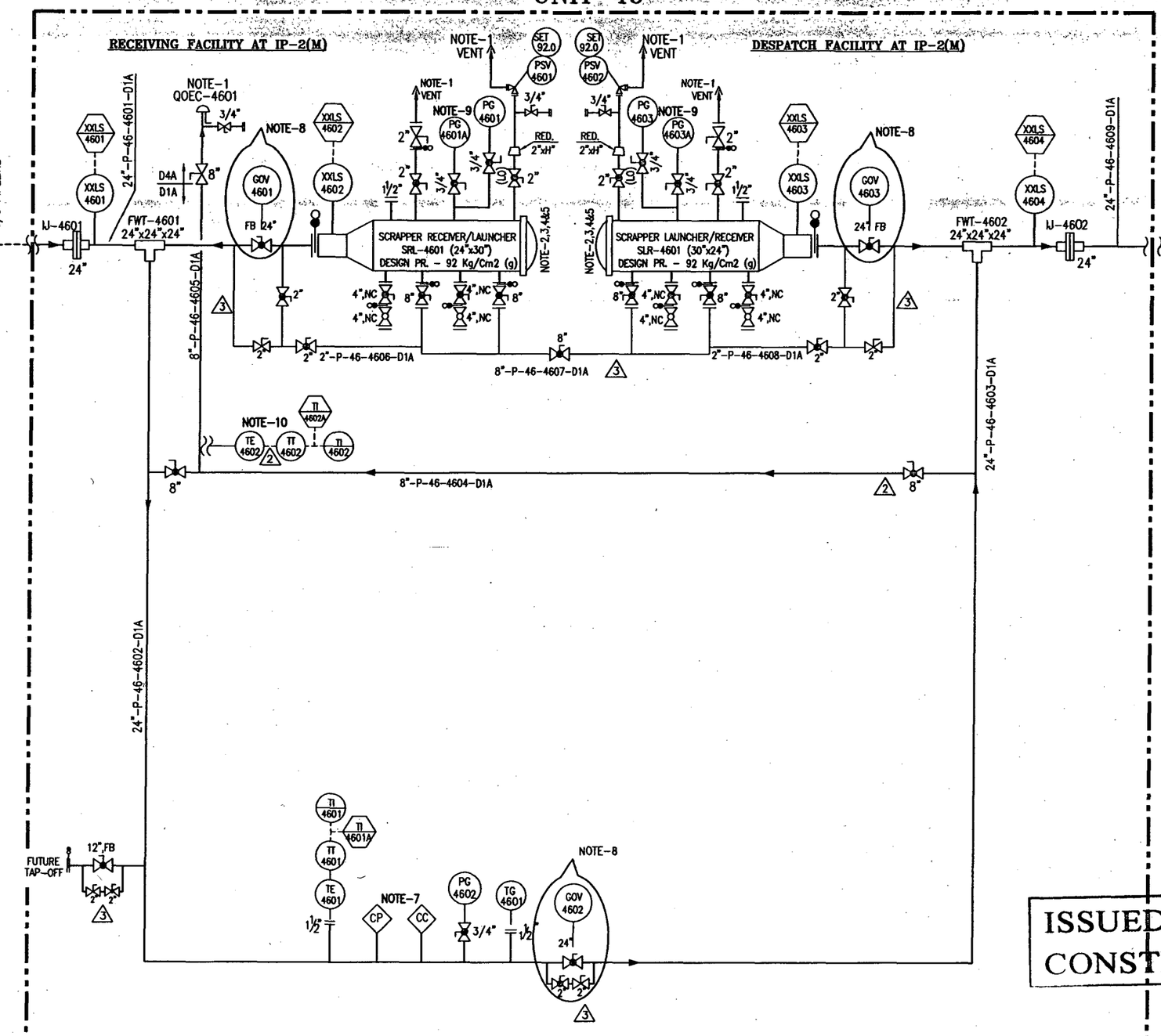
DRG. NO. MEC/23ME/05/28/M/001/0018

REV 2

REV	INST.
SEC	CONCURRED BY

DRG. NO. MEC/23ME/05/28/M/001/0019

UNIT-46



NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. SCRAPPER LAUNCHER/RECEIVER SHALL HAVE SCRAPPER HANDLING FACILITY COMPIRING OF A JIB CRANE & A TROLLY AND SHALL HAVE A QUICK OPPENING CLOSURE.
3. SCRAPPER LAUNCHER/RECEIVER SHALL BE SUITABLE FOR HANDLING INTELLIGENT PIGS.
4. DELETED.
5. SCRAPPER DOOR MECHANISM TO BE CONSTRUCTED SUCH THAT THE DOOR CAN NOT BE OPENED UNLESS SCRAPPER TRAP IS FULLY DEPRESSURISED.
6. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
7. ONLINE RETRIVEL TYPE CORROSION MONITORING COUPON AND CORROSION PROBE SHALL BE PROVIDED.
8. FOR SV & GOV DETAIL REFER DRG. NO. MEC/23ME/05/28/M/001/0023-0030
9. PG-4601 & 4603 SHALL HAVE A RANGE OF 0-1 Kg/Cm2(g) WITH A GAUGE SAVER.
10. DIRECT SURFACE CONTACT TYPE.

PROCESS DATA

FLUID	: NATURAL GAS/RLNG
FLOW	: 6.88 MMSCMD (APPX.)
PRESSURE	: 60-63 KG/Cm2(G)
DESIGN	: 92 KG/Cm2(G)
TEMPERATURE	
WORKING	: 0° TO 55° C
DESIGN	: -29 TO 65°C
DESIGN CLASS	: 600#

LINE LEGEND

PROPOSED LINE A/G
PROPOSED LINE U/G

24"-P-46-4601-D1A
8"-P-46-4601-D1A
MATERIAL SPEC.
LINE NO.
UNIT NO.
PROCESS FLUID (RLNG)
LINE SIZE (NOMINAL)

VALVE LEGEND

BALL VALVE FLANGE END
BALL VALVE BW END/UPTO 1½" SW END.
PLUG VALVE BW END/UPTO 1½" SW END.
PLUG VALVE FLANGE END
GLOBE VALVE.

ISSUED FOR CONSTRUCTION

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED
मेकॉन लिमिटेड
MECON LIMITED

INTERMEDIATE PIGGING STATION-2(M)
CH. 195.166 Km. (APPROX.)

REV NO	DATE	ZONE	DESCRIPTION	BY	VERIFIED
3	03.02.12		REVISED AS MARKED 3	AKB	GVW
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVW
1	26.05.11	-	GENERAL REVISION	AKB	GVW

REFERENCES: PIPLINE NETWORK SCHEMATIC DIAGRAM — MEC/23ME/05/28/M/001/0021

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SIG (G.V.W.)
DATE	08.02.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

P & ID FOR INTERMEDIATE PIGGING STATION IP-2(M) (SECTION-VII)

SCALE : NTS

DRG. NO. MEC/23ME/05/28/M/001/0019 REV 3

REV / SEC | INST. | CONCURRED BY

DRG. NO. MEC/23ME/05/28/M/001/0020

FROM MBC/...../0019

UNIT-47 | UNIT-48 | UNIT-49 | UNIT-50 | UNIT-51

SV-11(M) 24"FB — NOTE-5,6,7 CH:~212.127Km.

SV-12(M) 24"FB — NOTE-5,6,7 CH:~225.937Km.

SV-13(M) 24"FB — NOTE-5,6,7,9 CH:~242.388Km.

SV-14(M) 24"FB — NOTE-5,6,7,10 CH:~254.898Km.

SV-15(M) 24"FB — NOTE-5,6,7 CH:~275.644Km.

24"x354.328 Km (APPROX.) API-5L, Gr. X-70/80 U/G PIPELINE

SECTION-VIII

SECTION-VII

TO MEC/...../0021

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. NOTE DELETED.
3. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
4. ALL UNMANNED STATION SHALL BE PROVIDED WITH CO2 FLOODING SYSTEM AND ALL MANNED STATION SHALL BE WITH FM-200 FIRE SUPPRESSION SYSTEM.
5. ALL SV EXTENDED STEM BW, FULL BORE BALL VALVE.
6. BURRIED VALVE SHALL BE PROVIDED WITH CORROSION PROTECTION COATING.
7. FOR SV & GOV DETAIL REFER DRG. NO. MEC/23ME/05/28/M/001/0023-0030
8. ALL SV STATIONS & TAP-OFF CHAINAGES HAS TO BE CONFIRMED BY GAIL.
9. FOR SV-13(M) SEE TYP. DRG. NO. MEC/23ME/05/28/M/001/0028.
10. FOR SV-14(M) SEE TYP. DRG. NO. MEC/23ME/05/28/M/001/0029.
10. ALL SV STATIONS ALONG MANGALORE LINE ARE CONSIDERED WITH FUTURE TAP-OFF.

PROCESS DATA

FLUID	: NATURAL GAS/RLNG	TEMPERATURE WORKING	: 0° TO 55° C
FLOW	: 5.383 MMSCMD (APPX.)	DESIGN	: -29 TO 65°C
PRESSURE	: 56-60 KG/Cm2(G)	DESIGN CLASS	: 600#
DESIGN	: 92 KG/Cm2(G)		

LINE LEGEND

——— PROPOSED LINE A/G
— — — PROPOSED LINE U/G

24"-P-46-4601-D1A
- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (RLNG)
- LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1 1/2" SW END.
- PLUG VALVE BW END/UPTO 1 1/2" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

ISSUED FOR CONSTRUCTION

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVW
1	26.05.11		GENERAL REVISION	AKB	GVW

PIPELINE NETWORK SCHEMATIC DIAGRAM — REFERENCES — DRG.NO. MEC/23ME/05/28/M/001/0021

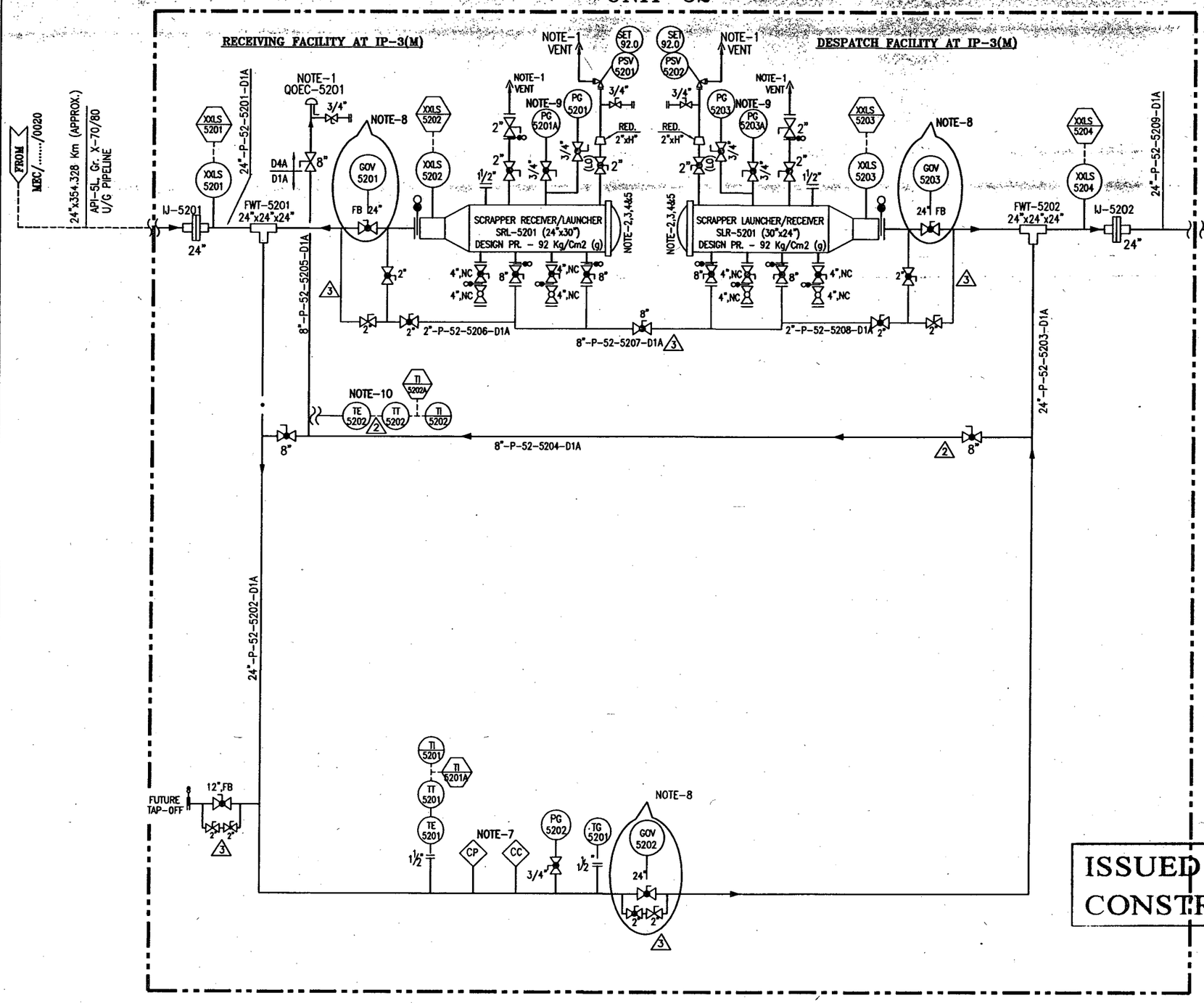
© Copyright MECON LIMITED - All rights reserved. THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS	KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)	
LOCATION	DELHI		
DESIGNED	AKB	P & ID FOR SV STATIONSALONG THE PIPELINE FOR BANGALORE-MANGALORE PHASE-2 PIPELINE (SECTION - VII & VIII)	
DRAWN	SUNIL		
CHECKED AND VERIFIED	GVW	SCALE : NTS	REV
APPROVED	SIG (G.V.W.)	DRG. NO. MEC/23ME/05/28/M/001/0020	2
	DATE 08.02.2011		

REV / SEC | INST. | CONCURRED BY

DRG. NO. MEC/23ME/05/28/M/001/0021

UNIT-52



INTERMEDIATE PIGGING STATION-3(M)
CH. 292.315 Km. (APPROX.)

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. SCRAPPER LAUNCHER/RECEIVER SHALL HAVE SCRAPPER HANDLING FACILITY COMPIRING OF A JIB CRANE & A TROLLY AND SHALL HAVE A QUICK OPPENING CLOSURE.
3. SCRAPPER LAUNCHER/RECEIVER SHALL BE SUITABLE FOR HANDLING INTELLIGENT PIGS.
4. DELETED.
5. SCRAPPER DOOR MECHANISM TO BE CONSTRUCTED SUCH THAT THE DOOR CAN NOT BE OPENED UNLESS SCRAPPER TRAP IS FULLY DEPRESSURISED.
6. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
7. ONLINE RETRIVEL TYPE CORROSION MONITORING COUPON AND CORROSION PROBE SHALL BE PROVIDED.
8. FOR SV & GOV DETAIL REFER DRG. NO. MEC/23ME/05/28/M/001/0023-0030
9. PG-5201 & 5203 SHALL HAVE A RANGE OF 0-1 Kg/Cm2(g) WITH A GAUGE SAVER.
10. DIRECT SURFACE CONTACT TYPE.

PROCESS DATA

FLUID : NATURAL GAS/RLNG	TEMPERATURE
FLOW : 5.5 MMSCMD (APPX.)	WDRKING : 0° TO 55° C
PRESSURE : 53-56 KG/Cm2(G)	DESIGN : -29 TO 65°C
DESIGN : 92 KG/Cm2(G)	DESIGN CLASS : 600#

LINE LEGEND

PROPOSED LINE A/G
PROPOSED LINE U/G

24"-P-52-5201-D1A
8"-P-52-5201-D1A

- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (RLNG)
- LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

ISSUED FOR CONSTRUCTION

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED
मेकॉन लिमिटेड
MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
3	03.02.12		REVISED AS MARKED 3	AKB	GVW
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVW
1	28.05.11		GENERAL REVISION	AKB	GVW

PIPELINE NETWORK SCHEMATIC DIAGRAM — MEC/23ME/05/28/M/001/0021
REFERENCES — DRG.NO.

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SIG (G.V.W.)
	DATE 08.02.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

P & ID FOR INTERMEDIATE PIGGING STATION IP-3(M) (SECTION-VIII)

SCALE : NTS
DRG. NO. MEC/23ME/05/28/M/001/0021
REV 3

REV / SEC | INST. | CONCURRED BY

DRG. NO. MEC/23ME/05/28/M/001/0022

UNIT-56

UNIT-53 UNIT-54 UNIT-55

FROM MBC/...../0021

24"x354.328 Km (APPROX.) API-5L, Gr. X-70/80 U/G PIPELINE

SV-16(M) 24" FB — NOTE-8,9,10 CH:~308.00Km.

SV-17(M) 24" FB — NOTE-8,9,10 CH:~324.72Km.

SV-18(M) 24" FB — NOTE-8,9,10 CH:~341.051Km.

8" IJ-5601 UG AG 8" FB 2" 2"

TAP-OFF POINT FOR MCF CH-347.0 Km. (appx.) 3

IJ-5602 24"

XXLS 5601 XXLS 5601 24"-P-56-5601-D1A

NOTE-1 QOEC-5601 3/4" 8" D4A D1A 8"

FWT-5602 24"x24"x24"

NOTE-13 TE 5602 TT 5602 TI 5602 TI 5602A 2

GOV 5602 24" NOTE-10 3

24"-P-56-5602-D1A

NOTE-10 GOV 5601 24" FB

XXLS 5602 XXLS 5602

NOTE-1 PSV 5601 SET 92.0

3/4" RED. 2"xH" NOTE-12 PG 5601 PG 5601A NOTE-1

2" 3/4" (UG) 1½" 3/4" 2" 2"

NOTE-2,3,4&5

SCRAPPER RECEIVER/LAUNCHER DESIGN PR. - 92 Kg/Cm2 (g) SRL-5601 (24"x30")

PIG HANDLING DEVICE 2

2" 2" 3 2"-P-56-5605-D1A

4" NC 8" 4" NC 8" 4" NC 4" NC 8"-P-56-5604-D1A

8" 8"-P-56-5603-D1A

1½" TG 5601 3/4" PG 5602 1½" TE 5601 TT 5601 TI 5601 TI 5601A

CP NOTE-7 CC

12"-P-56-5605-D1A V 1½" 1½" 12" 2" 2" 24" 24" 3

METERING SKID MRPL

DETAIL-B

RECEIVING FACILITY AT MANGALORE (CH. ~354.328 KM.)

DETAIL-B 3

NOTES:

1. ALL VENTS SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. SCRAPPER LAUNCHER/RECEIVER SHALL HAVE SCRAPPER HANDLING FACILITY COMPIRING OF A JIB CRANE & A TROLLY AND SHALL HAVE A QUICK OPPENING CLOSURE.
3. SCRAPPER LAUNCHER/RECEIVER SHALL BE SUITABLE FOR HANDLING INTELLIGENT PIGS.
4. DELETED.
5. SCRAPPER DOOR MECHANISM TO BE CONSTRUCTED SUCH THAT THE DOOR CAN NOT BE OPENED UNLESS SCRAPPER TRAP IS FULLY DEPRESSURISED.
6. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
7. ONLINE RETRIVEL TYPE CORROSION MONITORING COUPON AND CORROSION PROBE SHALL BE PROVIDED.
8. ALL SV EXTENDED STEM BW, FULL BORE BALL VALVE.
9. BURRIED VALVE SHALL BE PROVIDED WITH CORROSION PROTECTION COATING.
10. FOR SV & GOV DETAIL REFER DRG. NO. MEC/23ME/05/28/M/001/0023-0030
11. ALL SV STATIONS & TAP-OFF CHAINAGES HAS TO BE CONFIRMED BY GAIL.
12. PG-5601 SHALL HAVE A RANGE OF 0-1 Kg/Cm2(g) WITH A GAUGE SAVER.
13. DIRECT SURFACE CONTACT TYPE.
14. ALL SV STATIONS ALONG MANGALORE LINE ARE CONSIDERED WITH FUTURE TAP-OFF.

ISSUED FOR CONSTRUCTION

PROCESS DATA

FLUID : NATURAL GAS/RLNG	TEMPERATURE
FLOW : 3.5 MMSCMD (APPX.)	WORKING : 0° TO 55°C
PRESSURE : 52-55 KG/Cm2(G)	DESIGN : -29 TO 65°C
DESIGN : 92 KG/Cm2(G)	DESIGN CLASS : 600#

LINE LEGEND

PROPOSED LINE A/G
PROPOSED LINE U/G

24"-P-56-5601-D1A
8"-P-56-5601-D1A
- MATERIAL SPEC.
- LINE NO.
- UNIT NO.
- PROCESS FLUID (RLNG)
- LINE SIZE (NOMINAL)

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
3	03.02.12		REVISED AS MARKED 3	AKB	GVW
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVW
1	28.06.11		GENERAL REVISION	AKB	GVW

REVISION

INST.

CONCURRED BY

PIPELINE NETWORK SCHEMATIC DIAGRAM — REFERENCES — MEC/23ME/05/28/M/001/0021 — DRG.NO.

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SIG (G.V.W.)
DATE	08.02.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

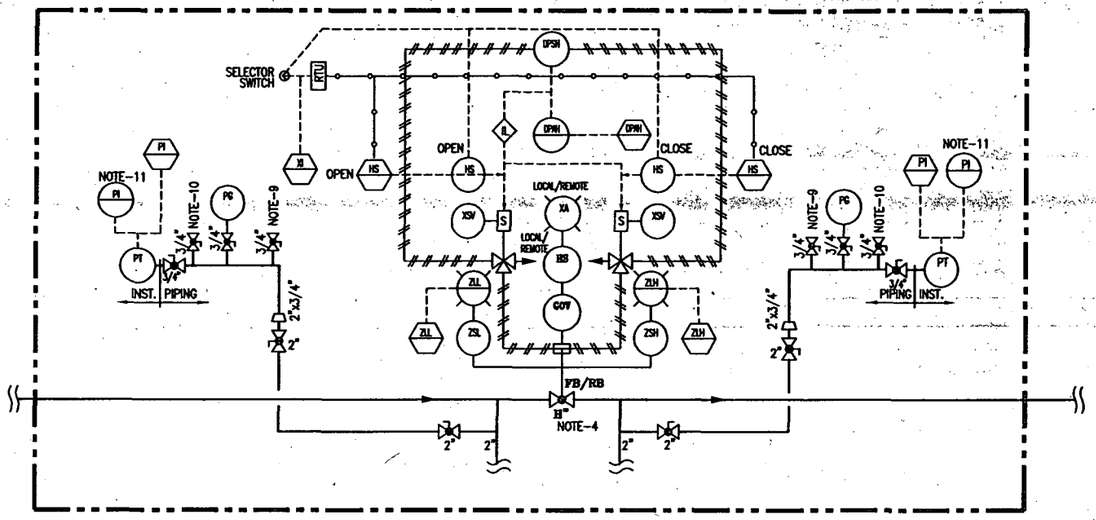
P & ID FOR RECEIVING TERMINAL AT MANGALORE (CH. 354.328 Km.) (SECTION-VIII)

SCALE : NTS

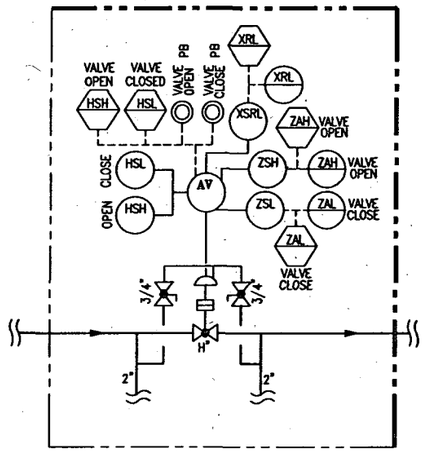
DRG. NO. MEC/23ME/05/28/M/001/0022

REV 3

DRG. NO. MEC/23ME/05/28/M/001/0023



TYPICAL ARRANGEMENT FOR GOV



TYPICAL ARRANGEMENT FOR AV

NOTE:-

1. ALL VENT SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL .
2. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
3. NOTE DELETED.
4. ALL GOV (GAS OVER OIL OPERATED VALVES) SHALL BE FAILED TO STAY PUT TYPE VALVE.
5. FOR ALL TAPPING FROM MAIN LINE, THE FIRST ISOLATION VALVE SHALL BE WELDED END TYPE AND OTHER SECOND VALVE MAY BE FLANGED CONNECTION.
6. ALL UNMANNED STATION SHALL BE PROVIDED WITH CO2 FLOODING SYSTEM AND ALL MANNED STATION SHALL BE WITH FM-200 FIRE SUPPRESSION SYSTEM.
7. INTEGRATED INTERLOCK SHOULD BE PROVIDED IN THE GAS ACTUATED VALVE SUCH THAT WITH HIGH ΔP ACROSS THE VALVE (>3 BAR), VALVE SHOULD NOT OPEN DURING START-UP.
8. ALL PG, PT CONNECTION SHALL BE TAKEN FROM 2" TWD ISOLATION VALVES AND THEN AFTER IT SHOULD BE CONVERTED TO REQUIRE NPT CONNECTION.
9. GAS TAPPING TO VALVE ACTUATOR.
10. GAS TAPPING FOR VALVE ΔP SWITCH.
11. FOR PG, PT, DPT DETAIL REFER MECON DRG. NO.-
    PT - MEC/05/E5/SD/PT/001
    DPT - MEC/05/E5/SD/DPT/003
    PG - MEC/05/E5/SD/PG/004

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

ISSUED FOR CONSTRUCTION

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

REV	DATE	ZONE	DESCRIPTION / REVISION	BY	VERIFIED
2	03.02.12		GENERAL REVISION	AKB	GVW
1	28.05.11		GENERAL REVISION	AKB	GVW

REV/SEC: INST. — CONCURRED BY

REFERENCES — DRG.NO.

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SIG (G.V.W.)
	DATE 08.02.2011

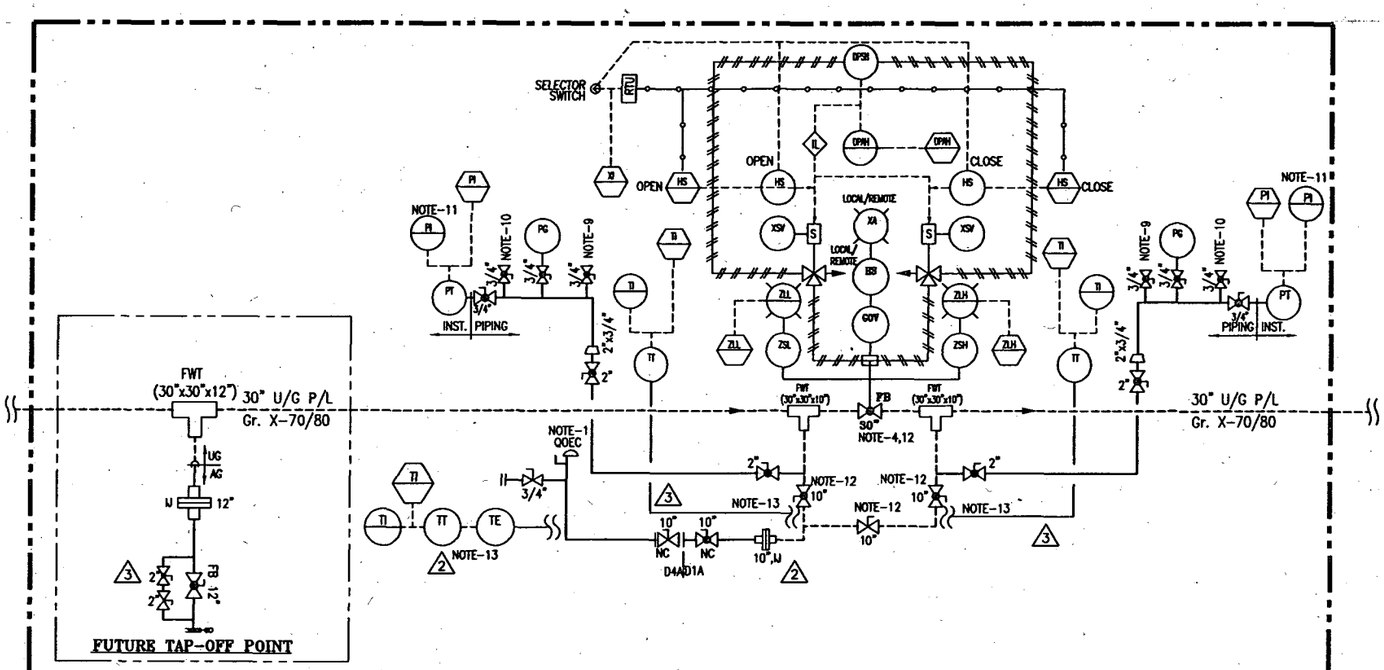
KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

TYPICAL ARRANGEMENT FOR AV & GOV

SCALE : NTS — REV 2

DRG. NO. MEC/23ME/05/28/M/001/0023

DRG. NO. MEC/23ME/05/28/M/001/0024



TYPICAL ARRANGEMENT FOR 30" SV (REMOTE OPERATED)

NOTE:-

1. ALL VENT SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
3. NOTE DELETED.
4. ALL GOV (GAS OVER OIL OPERATED VALVES) SHALL BE FAILED TO STAY PUT TYPE VALVE.
5. FOR ALL TAPPING FROM MAIN LINE, THE FIRST ISOLATION VALVE SHALL BE WELDED END TYPE AND OTHER SECOND VALVE MAY BE FLANGED CONNECTION.
6. ALL UNMANNED STATION SHALL BE PROVIDED WITH CO_2 FLOODING SYSTEM AND ALL MANNED STATION SHALL BE WITH FM-200 FIRE SUPPRESSION SYSTEM.
7. INTEGRATED INTERLOCK SHOULD BE PROVIDED IN THE GAS ACTUATED VALVE SUCH THAT WITH HIGH ΔP ACROSS THE VALVE (>3 BAR), VALVE SHOULD NOT OPEN DURING START-UP.
8. ALL PG, PT CONNECTION SHALL BE TAKEN FROM 2" TWO ISOLATION VALVES AND THEN AFTER IT SHOULD BE CONVERTED TO REQUIRE NPT CONNECTION.
9. GAS TAPPING TO VALVE ACTUATOR.
10. GAS TAPPING FOR VALVE ΔP SWITCH.
11. FOR PG, PT, DPT DETAIL REFER MECON DRG. NO.-
    PT - MEC/05/E5/SD/PT/001
    DPT - MEC/05/E5/SD/DPT/003
    PG - MEC/05/E5/SD/PG/004
12. EXTENDED STEM VALVE.
13. DIRECT SURFACE CONTACT TYPE.
14. THIS IS TYPICAL ARRANGEMENT FOR 30" SV STATIONS. FOR 30" SV-2 SEE TYP. DRG. NO. MEC/23ME/05/28/M/001/0028.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1 1/2" SW END.
- PLUG VALVE BW END/UPTO 1 1/2" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

ISSUED FOR CONSTRUCTION

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

REV	DATE	ZONE	DESCRIPTION / REVISION	BY	VERIFIED
3	03.02.12		REVISED AS MARKED 3	AKB	GVW
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVW
1	26.05.11		GENERAL REVISION	AKB	GVW

REV / SEC: INST. — CONCURRED BY

REFERENCES — DRG.NO.

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SKG (G.V.W.)
DATE	08.02.2011

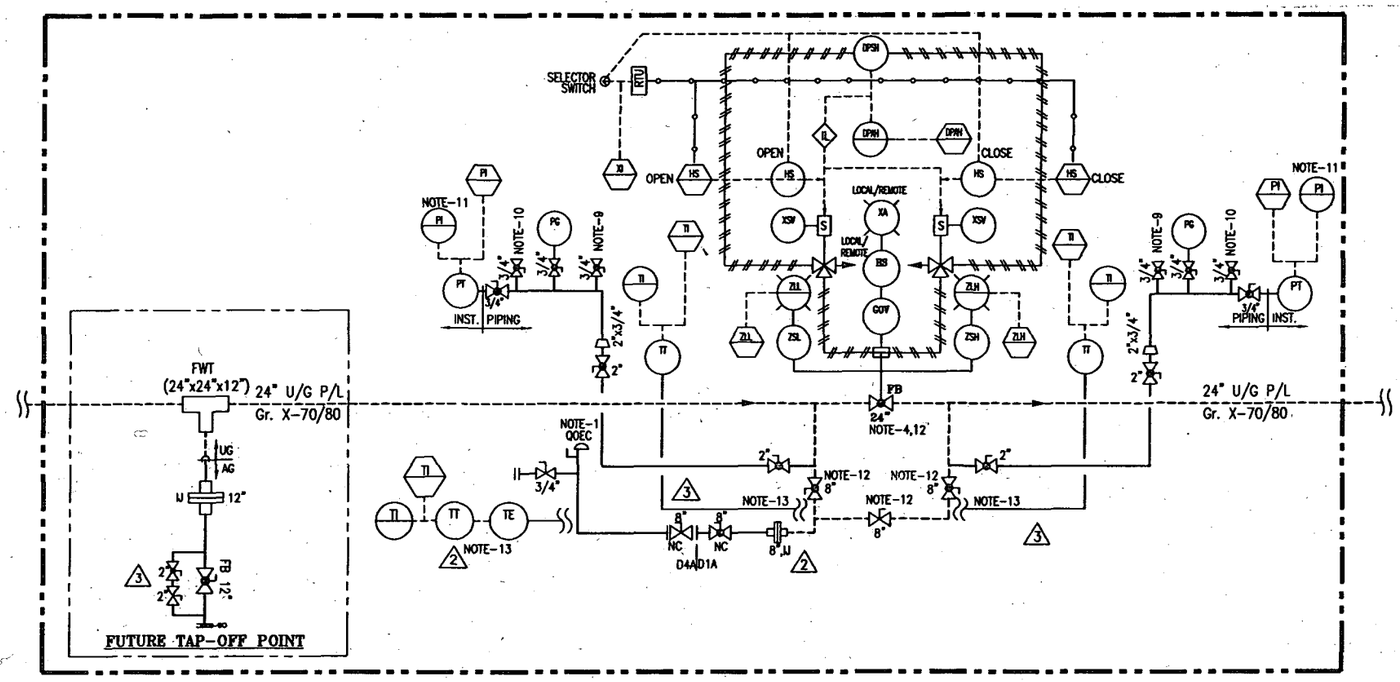
KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

TYPICAL ARRANGEMENT FOR 30" SV STATIONS (REMOTE OPERATED)

SCALE : NTS

DRG. NO. MEC/23ME/05/28/M/001/0024 — REV 3

DRG. NO. MEC/23ME/05/28/M/001/0025



TYPICAL ARRANGEMENT FOR 24" SV (REMOTE OPERATED)

NOTE:-

1. ALL VENT SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
3. NOTE DELETED.
4. ALL GOV (GAS OVER OIL OPERATED VALVES) SHALL BE FAILED TO STAY PUT TYPE VALVE.
5. FOR ALL TAPPING FROM MAIN LINE, THE FIRST ISOLATION VALVE SHALL BE WELDED END TYPE AND OTHER SECOND VALVE MAY BE FLANGED CONNECTION.
6. ALL UNMANNED STATION SHALL BE PROVIDED WITH CO2 FLOODING SYSTEM AND ALL MANNED STATION SHALL BE WITH FM-200 FIRE SUPPRESSION SYSTEM.
7. INTEGRATED INTERLOCK SHOULD BE PROVIDED IN THE GAS ACTUATED VALVE SUCH THAT WITH HIGH ΔP ACROSS THE VALVE (>3 BAR), VALVE SHOULD NOT OPEN DURING START-UP.
8. ALL PG, PT CONNECTION SHALL BE TAKEN FROM 2" TWO ISOLATION VALVES AND THEN AFTER IT SHOULD BE CONVERTED TO REQUIRE NPT CONNECTION.
9. GAS TAPPING TO VALVE ACTUATOR.
10. GAS TAPPING FOR VALVE ΔP SWITCH.
11. FOR PG, PT, DPT DETAIL REFER MECON DRG. NO.-
    PT - MEC/05/E5/SD/PT/001
    DPT - MEC/05/E5/SD/DPT/003
    PG - MEC/05/E5/SD/PG/004
12. EXTENDED STEM VALVE.
13. DIRECT SURFACE CONTACT TYPE.
14. THIS IS TYPICAL ARRANGEMENT FOR 24" SV STATIONS. FOR 24" SV-9, SV-11, SV-12, SV-13, SV-15, SV-18, SV-19, SV-2(M), SV-10(M), SV-13(M) & SV-14(M) SEE TYP. DRG. NO. MEC/23ME/05/28/M/001/0026-0030

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1 1/2" SW END.
- PLUG VALVE BW END/UPTO 1 1/2" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

ISSUED FOR CONSTRUCTION

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

REV	DATE	ZONE	DESCRIPTION / REVISION	BY	VERIFIED
3	03.02.12		REVISED AS MARKED 3	AKB	GVW
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVW
1	26.05.11		GENERAL REVISION	AKB	GVW

REFERENCES | DRG.NO.

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SIG (G.V.W.)
	DATE 08.02.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

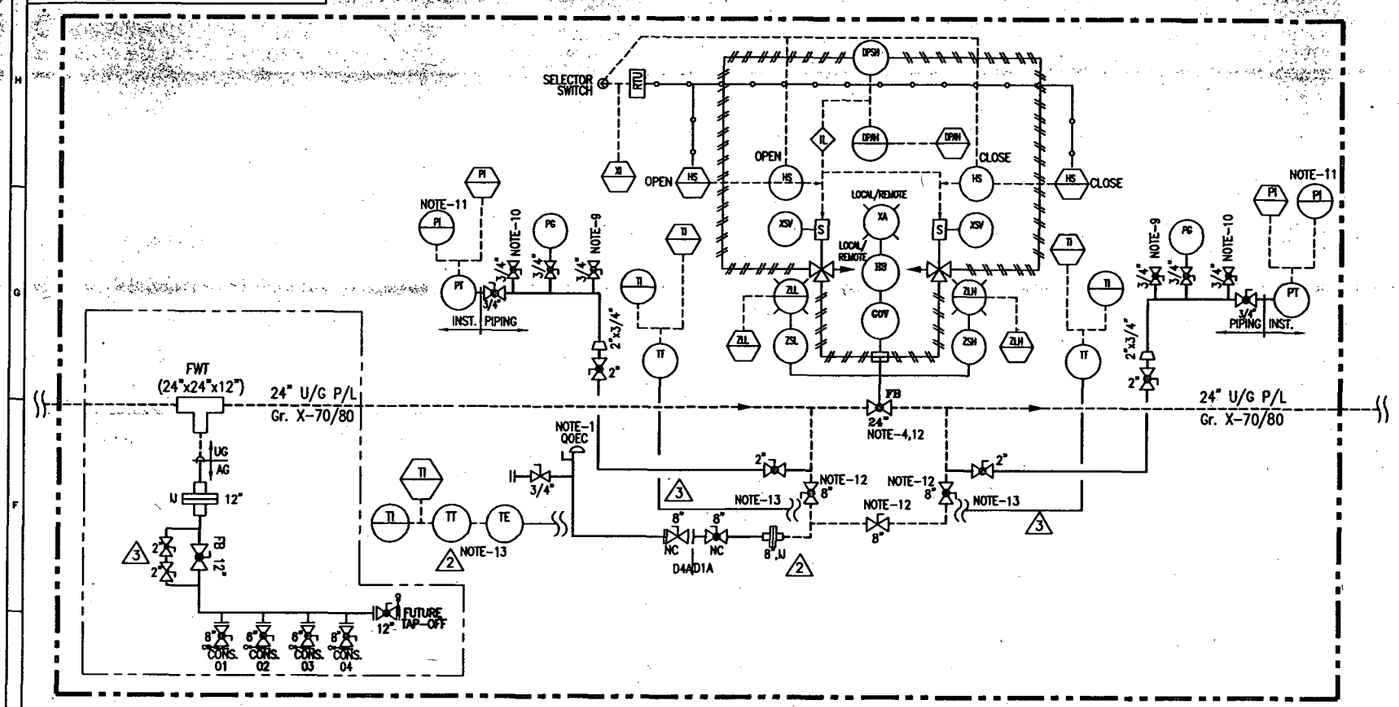
TYPICAL ARRANGEMENT FOR 24" SV STATIONS (REMOTE OPERATED)

SCALE : NTS

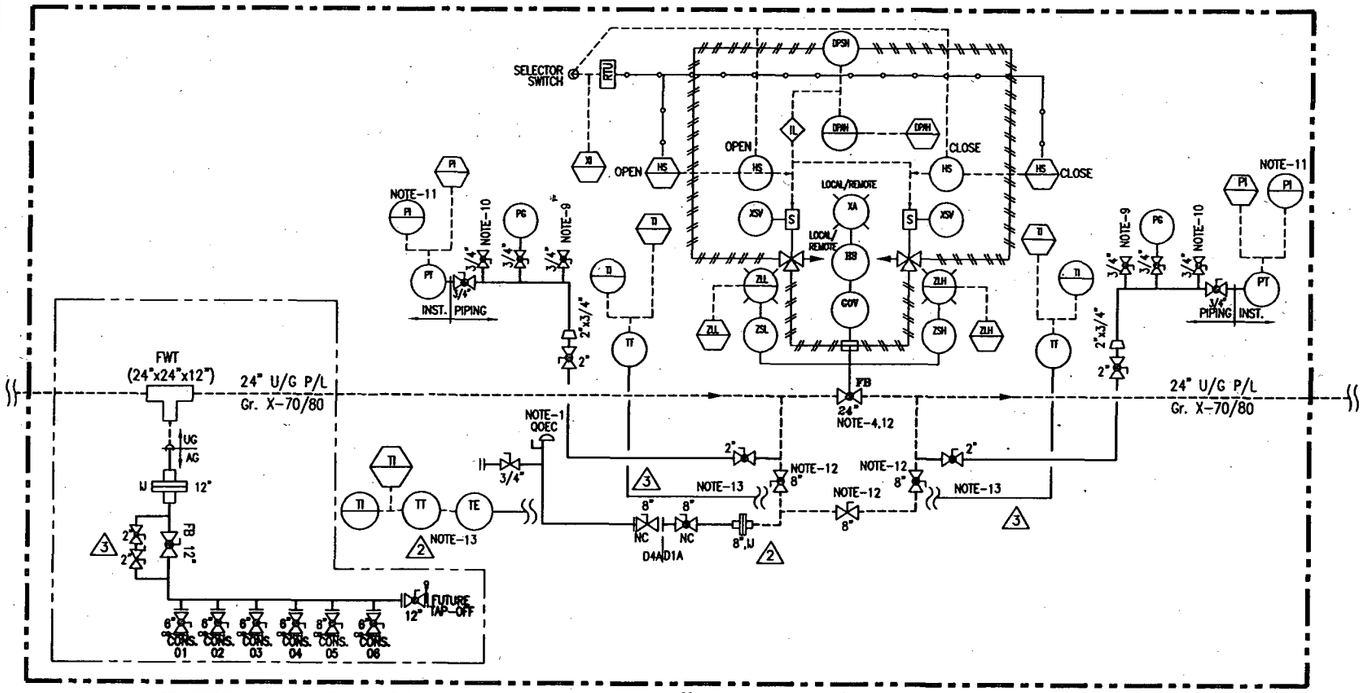
DRG. NO. MEC/23ME/05/28/M/001/0025 REV 3

REV / SEC | INST. | CONCURRED BY

DRG. NO. MEC/23ME/05/28/M/001/0026



TYPICAL ARRANGEMENT FOR 24" SV-11 (REMOTE OPERATED)



TYPICAL ARRANGEMENT FOR 24" SV-15 (REMOTE OPERATED)

TAP-OFF DETAILS AT SV-11

SR.NO.	CONS. NO.	CONS. NAME	TAP-OFF
1.	CONS.-01	SRI KANAPPIRAN MILLS	8"
2.	CONS.-02	TEXMO PUMP DIVISION	6"
3.	CONS.-03	TEXMO MOTOR DIVISION	6"
4.	CONS.-04	LGB KOVILPALAYAM	8"

TAP-OFF DETAILS AT SV-15

SR.NO.	CONS. NO.	CONS. NAME	TAP-OFF
1.	CONS.-01	AGNI STEEL	6"
2.	CONS.-02	ROCHA PARRYWARE	6"
3.	CONS.-03	RAN INDIA STEEL	6"
4.	CONS.-04	SHESHYAEE PAPER	6"
5.	CONS.-05	SRI VELA SMELTERS	8"
6.	CONS.-06	PAVAI ALLOYS	6"

NOTE:-

1. ALL VENT SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL .
2. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
3. NOTE DELETED.
4. ALL GOV (GAS OVER OIL OPERATED VALVES) SHALL BE FAILED TO STAY PUT TYPE VALVE.
5. FOR ALL TAPPING FROM MAIN LINE, THE FIRST ISOLATION VALVE SHALL BE WELDED END TYPE AND OTHER SECOND VALVE MAY BE FLANGED CONNECTION.
6. ALL UNMANNED STATION SHALL BE PROVIDED WITH CO2 FLOODING SYSTEM AND ALL MANNED STATION SHALL BE WITH FM-200 FIRE SUPPRESSION SYSTEM.
7. INTEGRATED INTERLOCK SHOULD BE PROVIDED IN THE GAS ACTUATED VALVE SUCH THAT WITH HIGH △P ACROSS THE VALVE (>3 BAR), VALVE SHOULD NOT OPEN DURING START-UP.
8. ALL PG, PT CONNECTION SHALL BE TAKEN FROM 2" TWO ISOLATION VALVES AND THEN AFTER IT SHOULD BE CONVERTED TO REQUIRE NPT CONNECTION.
9. GAS TAPPING TO VALVE ACTUATOR.
10. GAS TAPPING FOR VALVE △P SWITCH.
11. FOR PG, PT, DPT DETAIL REFER MECON DRG. NO.-
    PT - MEC/05/E5/SD/PT/001
    DPT - MEC/05/E5/SD/DPT/003
    PG - MEC/05/E5/SD/PG/004
12. EXTENDED STEM VALVE.
13. DIRECT SURFACE CONTACT TYPE.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

ISSUED FOR CONSTRUCTION

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
3	03.02.12		REVISED AS MARKED 3	AKB	GVW
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVW
1	28.05.11		GENERAL REVISION	AKB	GVW

REVISION

REFERENCES | DRG.NO.

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

REV / SEC | INST.

CONCURRED BY

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	(G.V.W.)
DATE	18.05.2011

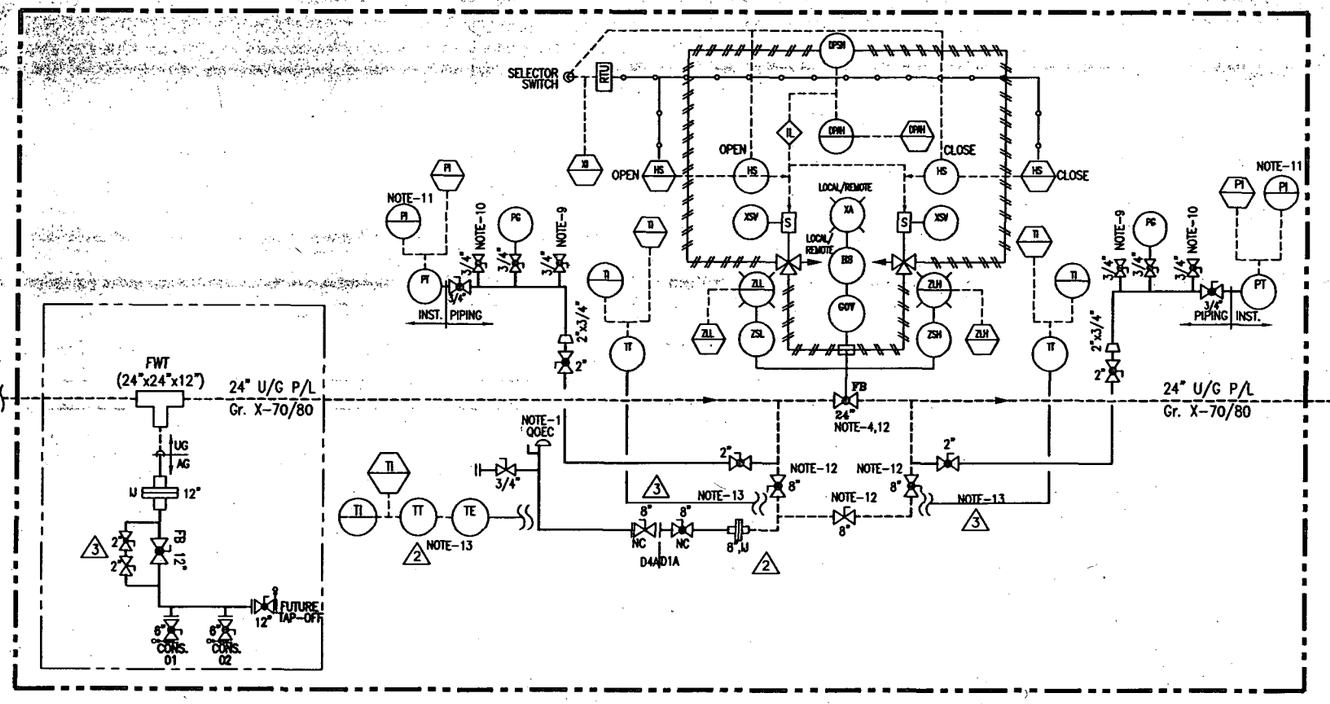
KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

TYPICAL ARRANGEMENT FOR 24" SV-11 & 15 STATIONS

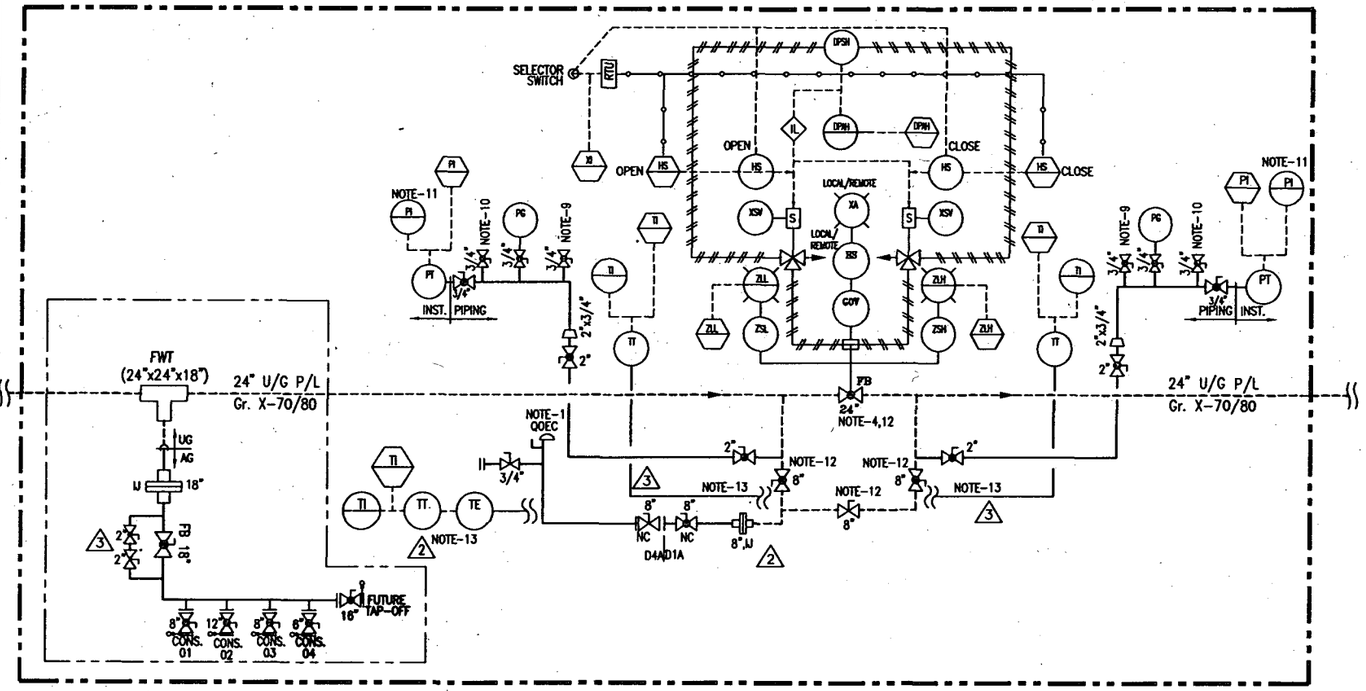
SCALE : NTS | REV

DRG. NO. MEC/23ME/05/28/M/001/0026 | 3

DRG. NO. MEC/23ME/05/28/M/001/0027



TYPICAL ARRANGEMENT FOR 24" SV-9 & 13 (REMOTE OPERATED)



TYPICAL ARRANGEMENT FOR 24" SV-12 (REMOTE OPERATED)

TAP-OFF DETAILS AT SV-9

SR.NO.	CONS. NO.	CONS. NAME	TAP-OFF
1.	CONS.-01	PRE-COAT MERADIAN	6"
2.	CONS.-02	MALABAR CEMENTS	6"

TAP-OFF DETAILS AT SV-13

SR.NO.	CONS. NO.	CONS. NAME	TAP-OFF
1.	CONS.-01	S.A. TEXTILES	6"
2.	CONS.-02	GOMUKI SPINING MILLS	6"

TAP-OFF DETAILS AT SV-12

SR.NO.	CONS. NO.	CONS. NAME	TAP-OFF
1.	CONS.-01	LGB ANNUR	8"
2.	CONS.-02	LGB VAIMPALAYAM PLANT	12"
3.	CONS.-03	LGB PILLAPALAYAM PLANT	8"
4.	CONS.-04	FLOWLINK SYSTEMS	6"

NOTE:-

1. ALL VENT SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
3. NOTE DELETED.
4. ALL GOV (GAS OVER OIL OPERATED VALVES) SHALL BE FAILED TO STAY PUT TYPE VALVE.
5. FOR ALL TAPPING FROM MAIN LINE, THE FIRST ISOLATION VALVE SHALL BE WELDED END TYPE AND OTHER SECOND VALVE MAY BE FLANGED CONNECTION.
6. ALL UNMANNED STATION SHALL BE PROVIDED WITH CO2 FLOODING SYSTEM AND ALL MANNED STATION SHALL BE WITH FM-200 FIRE SUPPRESSION SYSTEM.
7. INTEGRATED INTERLOCK SHOULD BE PROVIDED IN THE GAS ACTUATED VALVE SUCH THAT WITH HIGH △P ACROSS THE VALVE (>3 BAR), VALVE SHOULD NOT OPEN DURING START-UP.
8. ALL PG, PT CONNECTION SHALL BE TAKEN FROM 2" TWO ISOLATION VALVES AND THEN AFTER IT SHOULD BE CONVERTED TO REQUIRE NPT CONNECTION.
9. GAS TAPPING TO VALVE ACTUATOR.
10. GAS TAPPING FOR VALVE △P SWITCH.
11. FOR PG, PT, DPT DETAIL REFER MECON DRG. NO.-
    PT - MEC/05/E5/SD/PT/001
    DPT - MEC/05/E5/SD/DPT/003
    PG - MEC/05/E5/SD/PG/004
12. EXTENDED STEM VALVE.
13. DIRECT SURFACE CONTACT TYPE.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

ISSUED FOR CONSTRUCTION

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

REV	DATE	ZONE	DESCRIPTION / REVISION	BY	VERIFIED
3	03.02.12		REVISED AS MARKED 3	AKB	GVW
2	28.06.11		AS PER GAIL'S COMMENTS	AKB	GVW
1	28.05.11		GENERAL REVISION	AKB	GVW

REFERENCES | DRG.NO.

© Copyright MECON LIMITED - All rights reserved. THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

REV / SEC | INST. | CONCURRED BY

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SIG (G.V.W.)
	DATE 16.05.2011

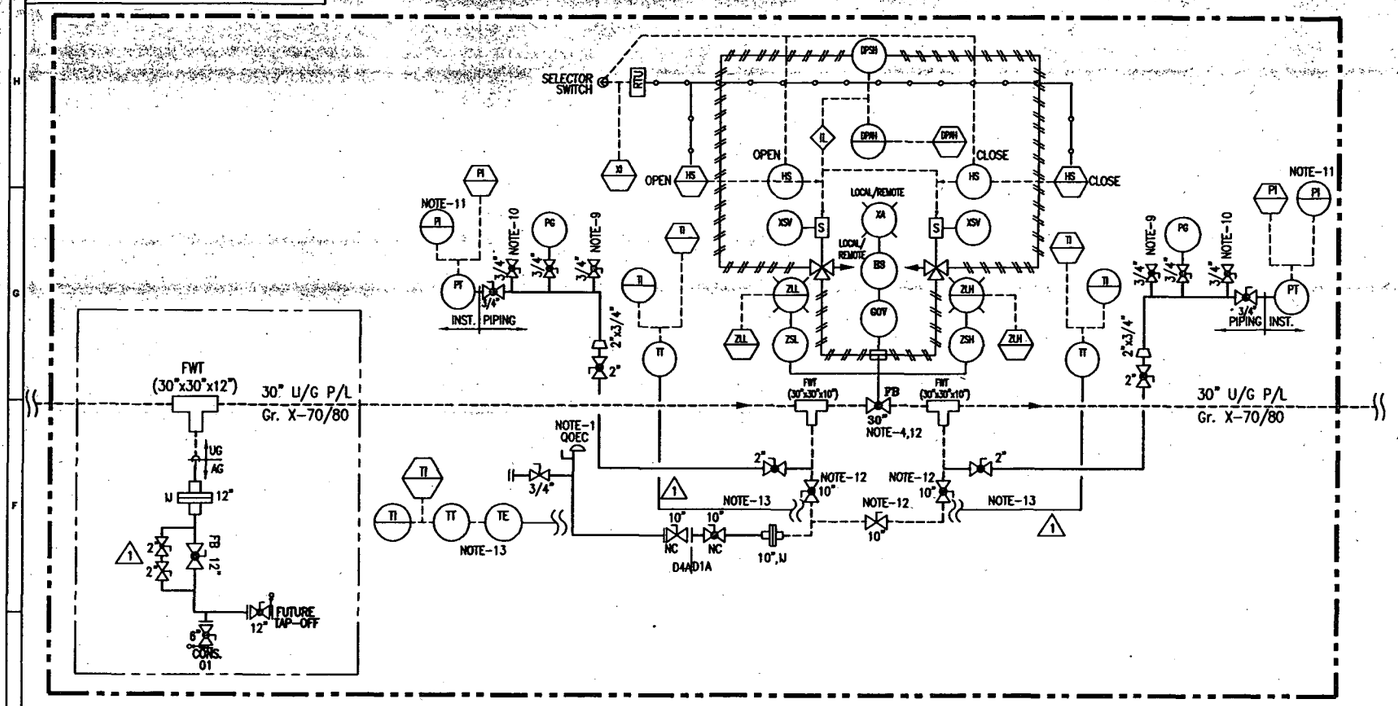
KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

TYPICAL ARRANGEMENT FOR 24" SV-9, 12 & 13 STATIONS

SCALE : NTS | REV

DRG. NO. MEC/23ME/05/28/M/001/0027 | 3

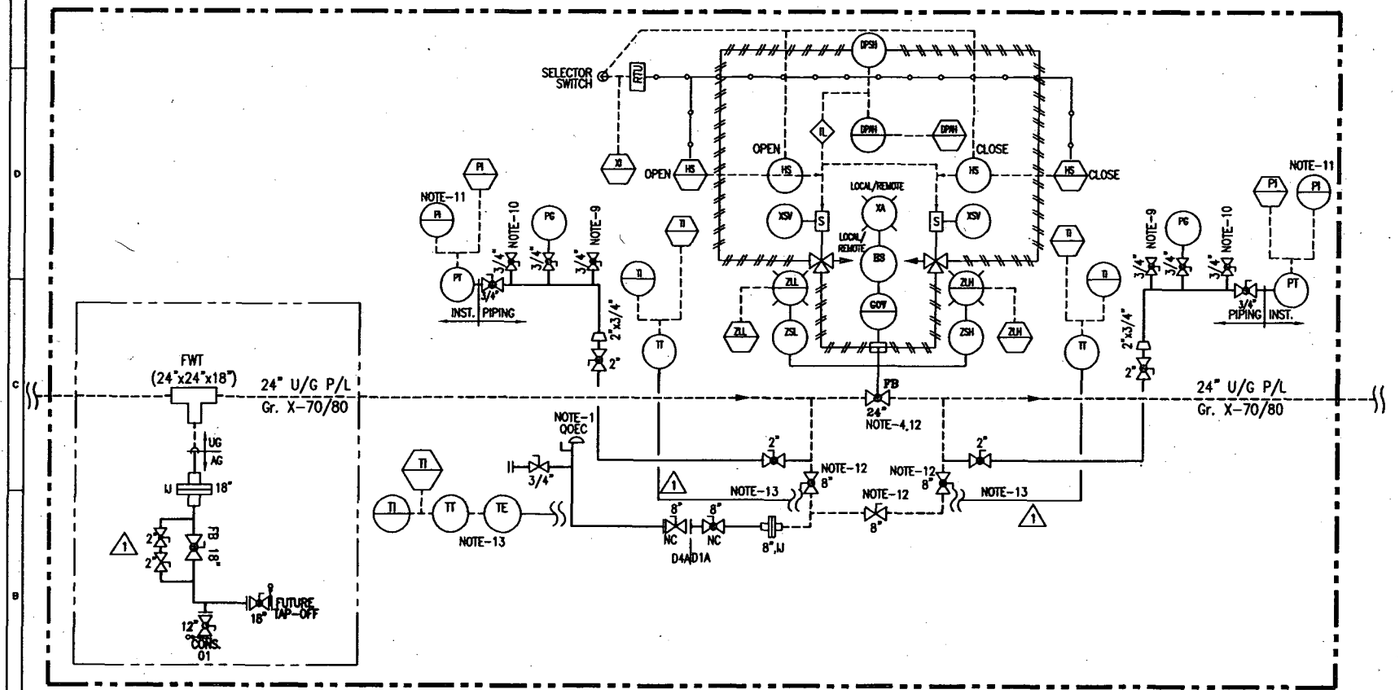
DRG. NO. MEC/23ME/05/28/M/001/0028



TYPICAL ARRANGEMENT FOR 30" SV-2 (REMOTE OPERATED)

TAP-OFF DETAILS AT SV-2

SR.NO.	CONS. NO.	CONS. NAME	TAP-OFF
1.	CONS.-01	APOLLO TYRE PERAMBRA	6"



TYPICAL ARRANGEMENT FOR 24" SV-13(M) (REMOTE OPERATED)

TAP-OFF DETAILS AT SV-13(M)

SR.NO.	CONS. NO.	CONS. NAME	TAP-OFF
1.	CONS.-01	CHEEMENY POWER PLANT	12"

NOTE:-

1. ALL VENT SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL .
2. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
3. NOTE DELETED.
4. ALL GOV (GAS OVER OIL OPERATED VALVES) SHALL BE FAILED TO STAY PUT TYPE VALVE.
5. FOR ALL TAPPING FROM MAIN LINE, THE FIRST ISOLATION VALVE SHALL BE WELDED END TYPE AND OTHER SECOND VALVE MAY BE FLANGED CONNECTION.
6. ALL UNMANNED STATION SHALL BE PROVIDED WITH CO2 FLOODING SYSTEM AND ALL MANNED STATION SHALL BE WITH FM-200 FIRE SUPPRESSION SYSTEM.
7. INTEGRATED INTERLOCK SHOULD BE PROVIDED IN THE GAS ACTUATED VALVE SUCH THAT WITH HIGH △P ACROSS THE VALVE (>3 BAR), VALVE SHOULD NOT OPEN DURING START-UP.
8. ALL PG, PT CONNECTION SHALL BE TAKEN FROM 2" TWO ISOLATION VALVES AND THEN AFTER IT SHOULD BE CONVERTED TO REQUIRE NPT CONNECTION.
9. GAS TAPPING TO VALVE ACTUATOR.
10. GAS TAPPING FOR VALVE △P SWITCH.
11. FOR PG, PT, DPT DETAIL REFER MECON DRG. NO.-
    PT - MEC/05/E5/SD/PT/001
    DPT - MEC/05/E5/SD/DPT/003
    PG - MEC/05/E5/SD/PG/004
12. EXTENDED STEM VALVE.
13. DIRECT SURFACE CONTACT TYPE.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

ISSUED FOR CONSTRUCTION

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
1	03.02.12		REVISED AS MARKED	AKB	GVW

REVISION

REFERENCES | DRG.NO.

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SIG (G.V.W.)
DATE	13.06.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

TYPICAL ARRANGEMENT FOR 30" SV-2 & 24" SV-13(M) STATION

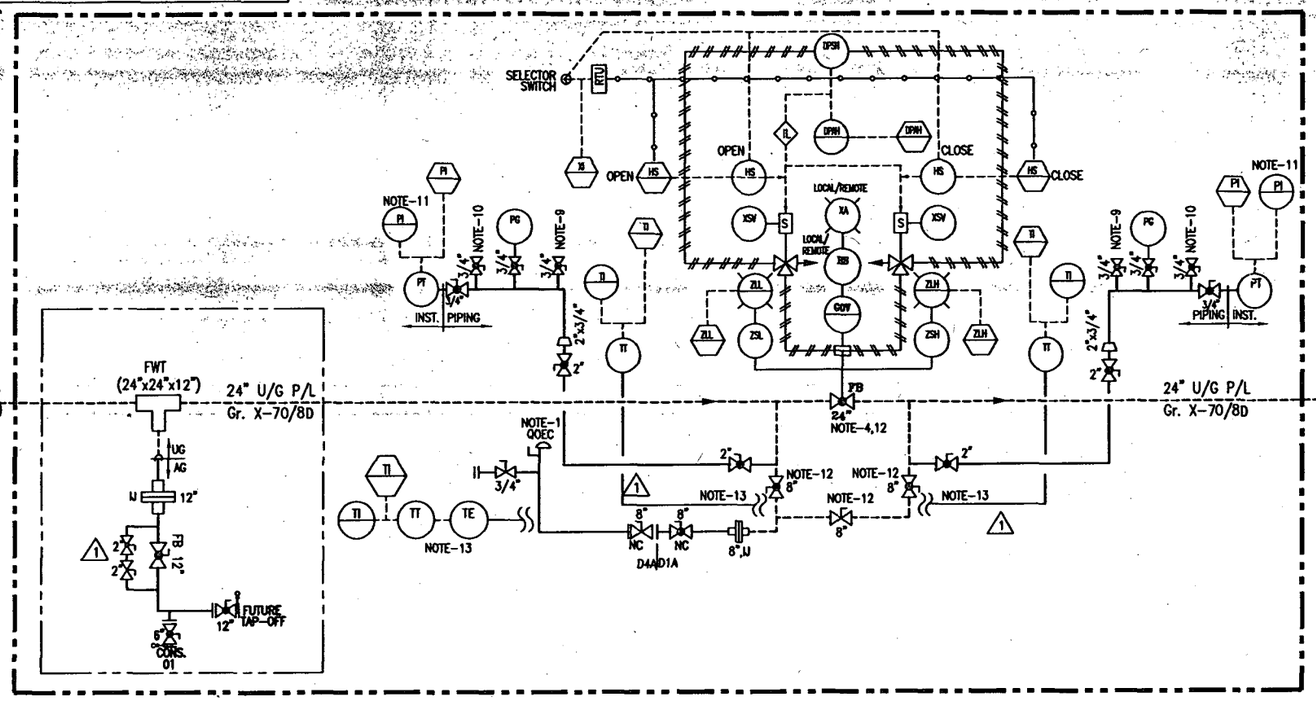
SCALE : NTS

DRG. NO. MEC/23ME/05/28/M/001/0028

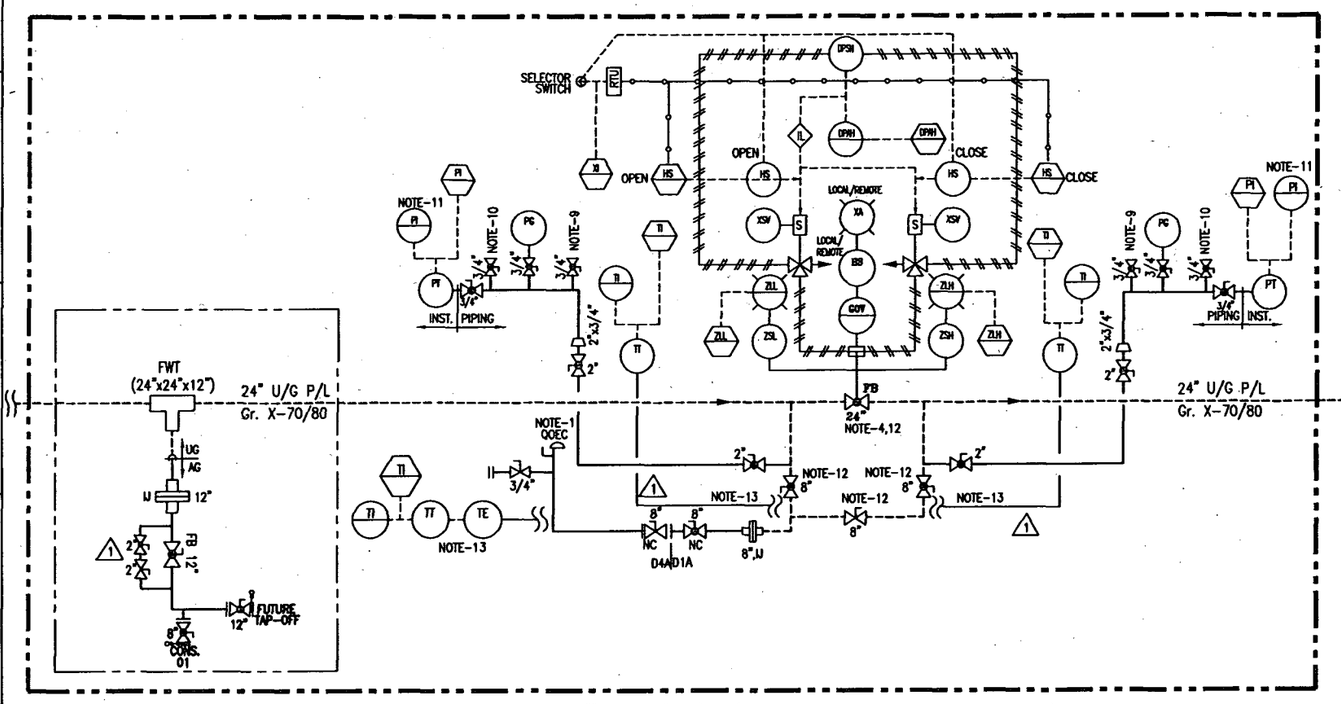
REV 1

REV / SEC | INST. | CONCURRED BY

DRG. NO. MEC/23ME/05/28/M/001/0029



TYPICAL ARRANGEMENT FOR 24" SV-2(M) & 10(M) (REMOTE OPERATED)



TYPICAL ARRANGEMENT FOR 24" 14(M) (REMOTE OPERATED)

TAP-OFF DETAILS AT SV-2(M)

SR.NO.	CONS. NO.	CONS. NAME	TAP-OFF
1.	CONS.-01	ARYA VAIDYASHALA	6"

TAP-OFF DETAILS AT SV-10(M)

SR.NO.	CONS. NO.	CONS. NAME	TAP-OFF
1.	CONS.-01	WESTERN INDIA PLYWOOD	6"

TAP-OFF DETAILS AT SV-14(M)

SR.NO.	CONS. NO.	CONS. NAME	TAP-OFF
1.	CONS.-01	KASARGAD POWER CORP.	8"

NOTE:-

1. ALL VENT SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL.
2. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
3. NOTE DELETED.
4. ALL GOV (GAS OVER OIL OPERATED VALVES) SHALL BE FAILED TO STAY PUT TYPE VALVE.
5. FOR ALL TAPPING FROM MAIN LINE, THE FIRST ISOLATION VALVE SHALL BE WELDED END TYPE AND OTHER SECOND VALVE MAY BE FLANGED CONNECTION.
6. ALL UNMANNED STATION SHALL BE PROVIDED WITH CO2 FLOODING SYSTEM AND ALL MANNED STATION SHALL BE WITH FM-200 FIRE SUPPRESSION SYSTEM.
7. INTEGRATED INTERLOCK SHOULD BE PROVIDED IN THE GAS ACTUATED VALVE SUCH THAT WITH HIGH △P ACROSS THE VALVE (>3 BAR), VALVE SHOULD NOT OPEN DURING START-UP.
8. ALL PG, PT CONNECTION SHALL BE TAKEN FROM 2" TWO ISOLATION VALVES AND THEN AFTER IT SHOULD BE CONVERTED TO REQUIRE NPT CONNECTION.
9. GAS TAPPING TO VALVE ACTUATOR.
10. GAS TAPPING FOR VALVE △P SWITCH.
11. FOR PG, PT, DPT DETAIL REFER MECON DRG. NO.-
    PT - MEC/05/E5/SD/PT/001
    DPT - MEC/05/E5/SD/DPT/003
    PG - MEC/05/E5/SD/PG/004
12. EXTENDED STEM VALVE.
13. DIRECT SURFACE CONTACT TYPE.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE BW END/UPTO 1½" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

ISSUED FOR CONSTRUCTION

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

REV	INST.
SEC	CONCURRED BY

REV.NO	DATE	ZONE	DESCRIPTION / REVISION	BY	VERIFIED
1	03.02.12		REVISED AS MARKED 1	AKB	GVW

REFERENCES | DRG.NO.

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	(G.V.W.)
DATE	13.06.2011

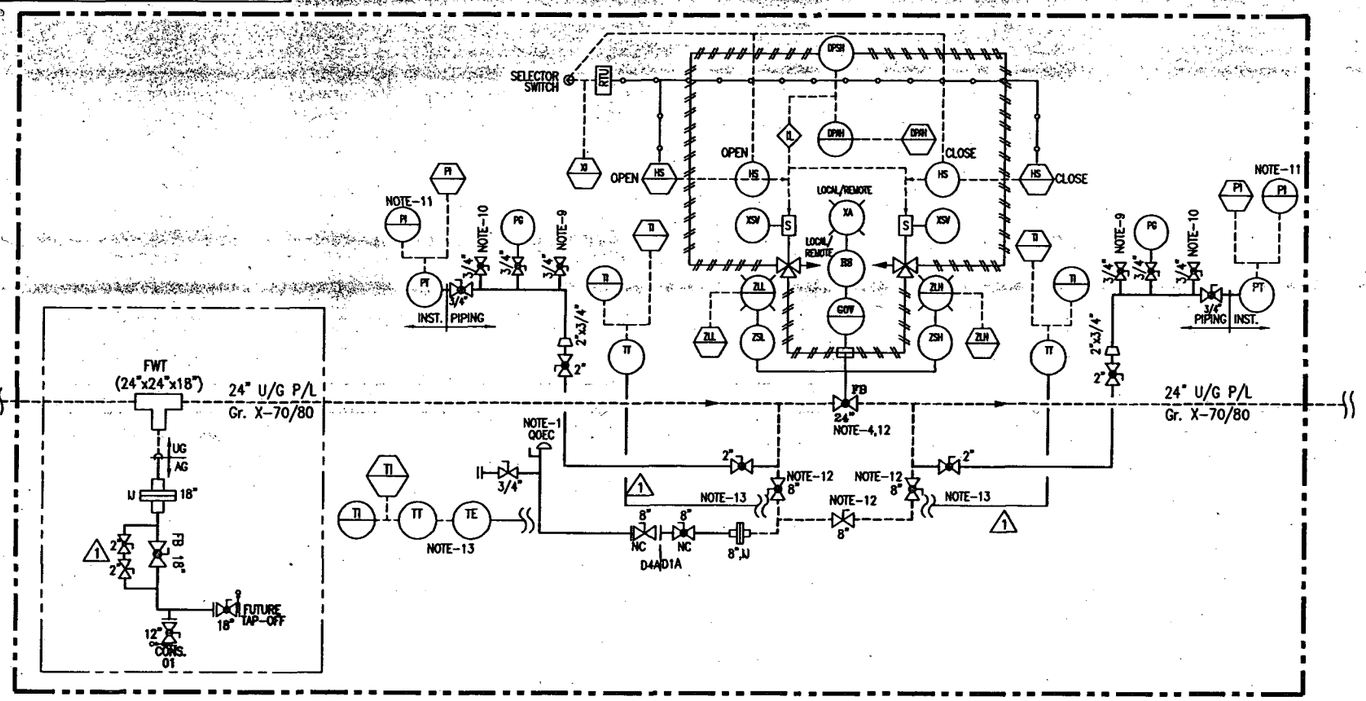
KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

TYPICAL ARRANGEMENT FOR 24" SV-2(M), 10(M) & 14(M) STATIONS

SCALE : NTS

DRG. NO. MEC/23ME/05/28/M/001/0029

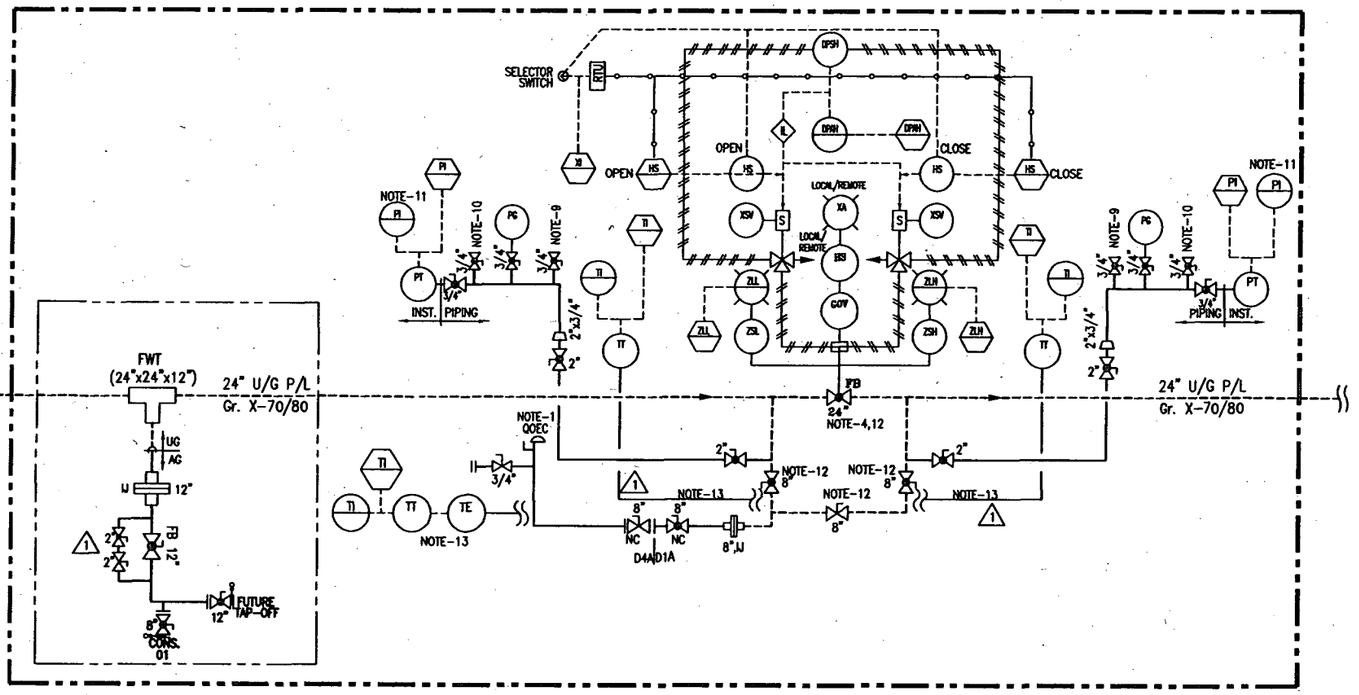
REV 1



TYPICAL ARRANGEMENT FOR 24" SV-18 (REMOTE OPERATED)

TAP-OFF DETAILS AT SV-18

SR.NO.	CONS. NO.	CONS. NAME	TAP-OFF
1.	CONS.-01	JSW STEEL	12"



TYPICAL ARRANGEMENT FOR 24" SV-19 (REMOTE OPERATED)

TAP-OFF DETAILS AT SV-19

SR.NO.	CONS. NO.	CONS. NAME	TAP-OFF
1.	CONS.-01	SALEM STEEL PLANT	8"

NOTE:-

1. ALL VENT SHALL BE LOCATED MIN. HEIGHT OF 3 MTR. ABOVE THE HIGHEST OPERATING LEVEL .
2. ALL BALL VALVES 2" & BELOW SHALL BE FULL BORE ONLY.
3. NOTE DELETED.
4. ALL GOV (GAS OVER OIL OPERATED VALVES) SHALL BE FAILED TO STAY PUT TYPE VALVE.
5. FOR ALL TAPPING FROM MAIN LINE, THE FIRST ISOLATION VALVE SHALL BE WELDED END TYPE AND OTHER SECOND VALVE MAY BE FLANGED CONNECTION.
6. ALL UNMANNED STATION SHALL BE PROVIDED WITH CO_2 FLOODING SYSTEM AND ALL MANNED STATION SHALL BE WITH FM-200 FIRE SUPPRESSION SYSTEM.
7. INTEGRATED INTERLOCK SHOULD BE PROVIDED IN THE GAS ACTUATED VALVE SUCH THAT WITH HIGH ΔP ACROSS THE VALVE (>3 BAR), VALVE SHOULD NOT OPEN DURING START-UP.
8. ALL PG, PT CONNECTION SHALL BE TAKEN FROM 2" TWO ISOLATION VALVES AND THEN AFTER IT SHOULD BE CONVERTED TO REQUIRE NPT CONNECTION.
9. GAS TAPPING TO VALVE ACTUATOR.
10. GAS TAPPING FOR VALVE ΔP SWITCH.
11. FOR PG, PT, DPT DETAIL REFER MECON DRG. NO.:-
    PT – MEC/05/E5/SD/PT/001
    DPT – MEC/05/E5/SD/DPT/003
    PG – MEC/05/E5/SD/PG/004
12. EXTENDED STEM VALVE.
13. DIRECT SURFACE CONTACT TYPE.

VALVE LEGEND

- BALL VALVE FLANGE END
- BALL VALVE BW END/UPTO 1 1/2" SW END.
- PLUG VALVE BW END/UPTO 1 1/2" SW END.
- PLUG VALVE FLANGE END
- GLOBE VALVE.

ISSUED FOR CONSTRUCTION

PRELIMINARY DRAWING

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

REV	INST.
SEC	CONCURRED BY

REV.NO	DATE	ZONE	DESCRIPTION	BY	VERIFIED
			REVISION		
1	03.02.12		REVISED AS MARKED	AKB	GVW

REFERENCES | DRG.NO.

© Copyright MECON LIMITED - All rights reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREON. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	AKB
DRAWN	SUNIL
CHECKED AND VERIFIED	GVW
APPROVED	SIG (G.V.W.)
DATE	13.08.2011

KOCHI-KOTTANAD-BANGLORE-MANGLORE NATURAL GAS PIPELINE PROJECT (PHASE-2)

TYPICAL ARRANGEMENT FOR 24" SV-18, & SV-19 STATIONS

SCALE : NTS

DRG. NO. MEC/23ME/05/28/M/001/0030

REV 1

ANNEXURE – VI

PIPELINE SCHEMATIC ROUTE DIAGRAM

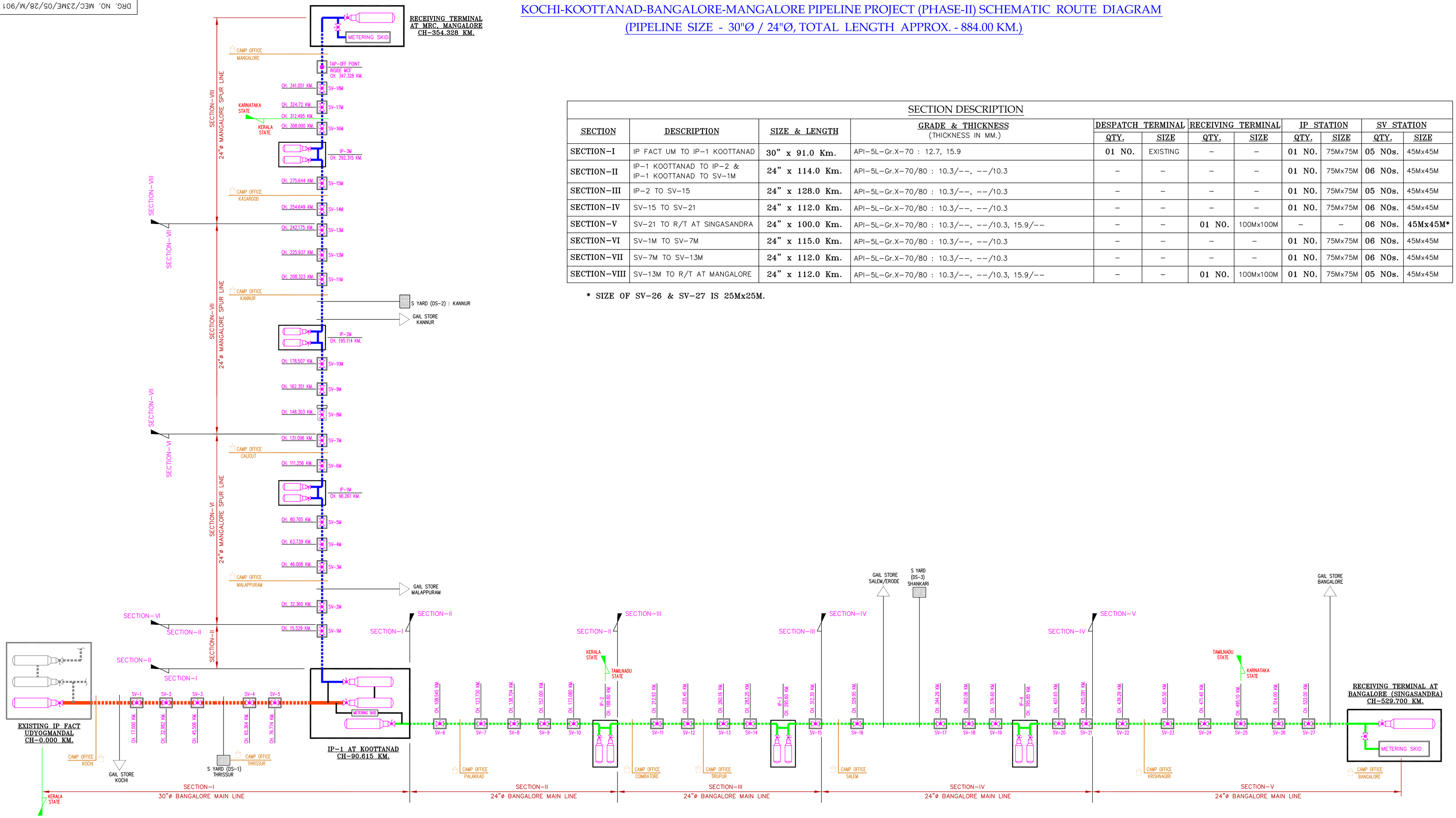
a) KKBMPL-PH-II

b) KKBMPL-PH-I

DRG. NO. MEC/23ME/05/28/M/901

KOCHI-KOOTTANAD-BANGALORE-MANGALORE PIPELINE PROJECT (PHASE-II) SCHEMATIC ROUTE DIAGRAM

(PIPELINE SIZE - 30"Ø / 24"Ø, TOTAL LENGTH APPROX. - 884.00 KM.)



SECTION DESCRIPTION

SECTION	DESCRIPTION	SIZE & LENGTH	GRADE & THICKNESS (THICKNESS IN MM.)	DESPATCH TERMINAL		RECEIVING TERMINAL		IP STATION		SV STATION	
				QTY.	SIZE	QTY.	SIZE	QTY.	SIZE	QTY.	SIZE
SECTION-I	IP FACT UM TO IP-1 KOOTTANAD	30" x 91.0 Km.	API-5L-Gr.X-70 : 12.7, 15.9	01 NO.	EXISTING	–	–	01 NO.	75Mx75M	05 NOs.	45Mx45M
SECTION-II	IP-1 KOOTTANAD TO IP-2 & IP-1 KOOTTANAD TO SV-1M	24" x 114.0 Km.	API-5L-Gr.X-70/80 : 10.3/--, --/10.3	–	–	–	–	01 NO.	75Mx75M	06 NOs.	45Mx45M
SECTION-III	IP-2 TO SV-15	24" x 128.0 Km.	API-5L-Gr.X-70/80 : 10.3/--, --/10.3	–	–	–	–	01 NO.	75Mx75M	05 NOs.	45Mx45M
SECTION-IV	SV-15 TO SV-21	24" x 112.0 Km.	API-5L-Gr.X-70/80 : 10.3/--, --/10.3	–	–	–	–	01 NO.	75Mx75M	06 NOs.	45Mx45M
SECTION-V	SV-21 TO R/T AT SINGASANDRA	24" x 100.0 Km.	API-5L-Gr.X-70/80 : 10.3/--, --/10.3, 15.9/--	–	–	01 NO.	100Mx100M	–	–	06 NOs.	45Mx45M*
SECTION-VI	SV-1M TO SV-7M	24" x 115.0 Km.	API-5L-Gr.X-70/80 : 10.3/--, --/10.3	–	–	–	–	01 NO.	75Mx75M	06 NOs.	45Mx45M
SECTION-VII	SV-7M TO SV-13M	24" x 112.0 Km.	API-5L-Gr.X-70/80 : 10.3/--, --/10.3	–	–	–	–	01 NO.	75Mx75M	06 NOs.	45Mx45M
SECTION-VIII	SV-13M TO R/T AT MANGALORE	24" x 112.0 Km.	API-5L-Gr.X-70/80 : 10.3/--, --/10.3, 15.9/--	–	–	01 NO.	100Mx100M	01 NO.	75Mx75M	05 NOs.	45Mx45M

* SIZE OF SV-26 & SV-27 IS 25Mx25M.

LEGEND

30"Ø BANGALORE MAIN LINE	PIPE STORAGE YARD (DS)	(03 NOs.)
24"Ø BANGALORE MAIN LINE	GAIL STORE	(05 NOs.)
24"Ø MANGALORE SPUR LINE	CAMP OFFICE	(13 NOs.)
	R/T	RECEIVING TERMINAL	(02 NOs.)
	D/T	DESPATCH TERMINAL	(01 NO.)
	SV	SECTIONALISING VALVE STATION	(45 NOs.)
	IP	INTERMEDIATE PIGGING STATION	(07 NOs.)

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

NOTES:-

1. ALL CHANAGES INDICATED ARE IN KMS.
2. ABOVE PIPELINE SCHEMATIC ROUTE DIAGRAM PREPARED BASED ON SURVEY DOCUMENT & DRAWING.
3. LOCATION IP, SV STATION & DUMP SITES ARE INDICATIVE ONLY AND EXACT LOCATIONS SHALL BE FINALISHED DEPENDING ON AVAILABILITY OF PLOT.
4. BATTERY LIMIT OF SECTION WILL BE 5.0M OUTSIDE THE BOUNDARY WALL OF LAST STATION (IP/SV) OF PREVIOUS SECTION.

REV	DATE	ZONE	DESCRIPTION	BY	VERIFIED
SEC			REVISION		

CONCURRED BY

DESIGN BASIS

SURVEY DOC.

SURVEY DRG.

REFERENCES DRG.NO.

© Copyright MECON – All right reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIQ PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS
LOCATION	DELHI
DESIGNED	HITESH
DRAWN	SUNIL
CHECKED AND VERIFIED	SUNIL KUMAR
APPROVED	SIG (A.K.S)
	DATE 02/11/2011

KOCHI-KOTTANAD-BANGALORE-MANGALORE NATURAL GAS PIPELINE PROJECT (PH-II)

PIPELINE NETWORK SCHEMATIC DIAGRAM

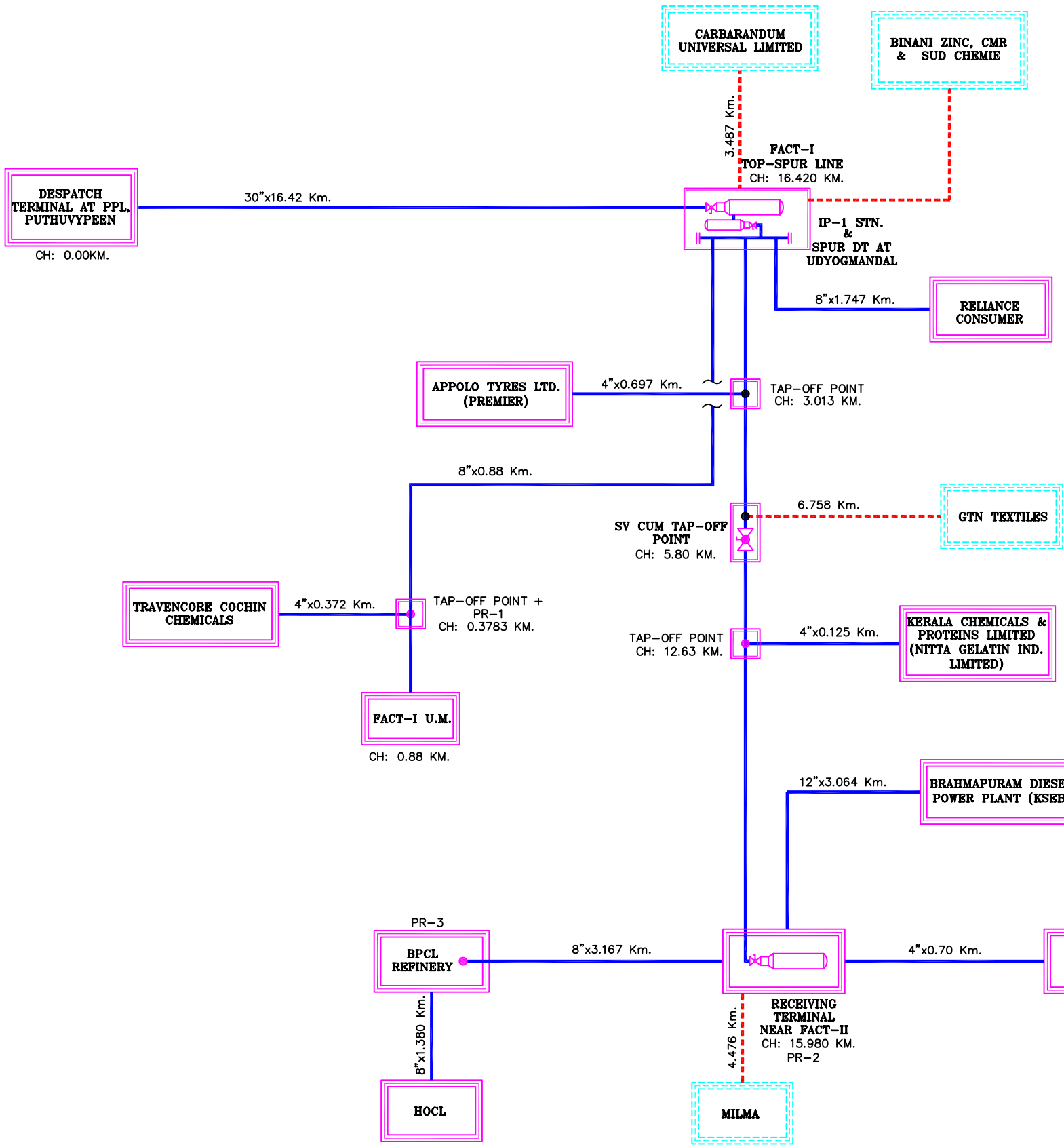
SCALE : NTS (SH 1 OF 1) REV

DRG. NO. MEC/23ME/05/28/M/901 0

DRG. NO. MEC/23M3/05/21/M/000/SK-01

KOCHI-KOTTANAD-BANGALORE-MANGALORE PIPELINE PROJECT (PHASE-I)

PETRONET LNG TERMINAL AT PUTHUVYPEEN TO IP AT UDYOGMANDAL



DETAIL OF CONSUMERS FOR PHASE-I

S.No.	CONSUMER	CAPACITY (MMSCMD)	PRESSURE Kg/Cm2	LENGTH (mtr.)	REMARKS
1.	TRAVENCORE COCHIN CHEMICALS	0.020000	06.00	372.15	
2.	FACT-I U.M.	1.440000	45.00	880.86	
3.	BSES/REL.	3.400000	50.00	1747.05	
4.	APPOLO TYRE LTD.	0.032000	21.00	697.28	
5.	NITTA GELATIN	0.030000	06.00	125.48	
6.	FACT-II TERMINAL	0.088000	10.00	15980.43	
7.	BRAHMAPURAM DIESEL POEWR PLANT (KSEB)	5.000000	25.00	3064.80	
8.	BPCL REFINERY	2.000000	45.00	3167.20	
9.	HOCL	0.170000	12.00	1380.03	

DETAIL OF CONSUMERS FOR PHASE-II

S.No.	CONSUMER	CAPACITY (MMSCMD)	PRESSURE Kg/Cm2	LENGTH (mtr.)	REMARKS
1.	CARBARANDUM UNIVERSAL LIMITED	0.024000	25.00	3487.95	
2.	BINANI ZINC	0.180000	25.00	18.74	
3.	CMR	0.006000	06.00	631.68	
4.	SUD CHEMIE	0.013000	07.00	730.26	
5.	GTN TEXTILES	0.000500	04.00	6758.16	
6.	PHILIPS CARBON	0.060000	07.00	3805.63	
7.	MILMA	0.002600	06.00	4476.26	

LEGENDS:-

PHASE-I

PHASE-II

NOTES :-

1. MAIN LINE FROM PUTHUVYPEEN TO SPUR LINE TAP-OFF (LENGTH=16.420 KM.)
2. SPUR LINE FROM IP-I (CH-16.420 KM.) TO FACT COCHIN AMBALAMUGAL (LENGTH=15.980 KM.)

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

REV	SEC	CONCURRED BY

REV. NO.	DATE	ZONE	DESCRIPTION	BY	VERIFIED
			REVISION		

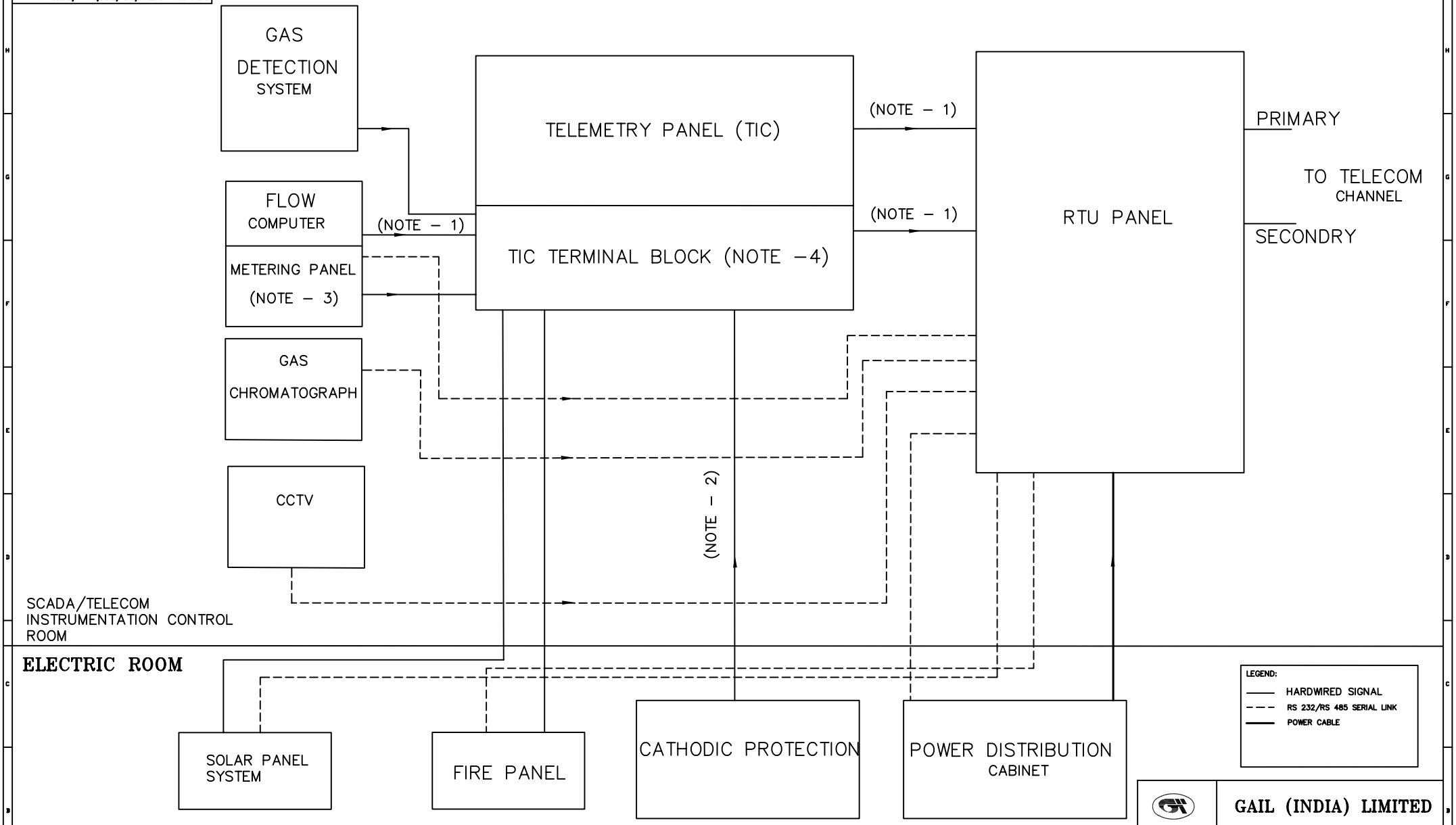
REFERENCES | DRG. NO.

© Copyright MECON - All right reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	OIL & GAS	KOCHI-KOTTANAD-BANGALORE-MANGALORE NATURAL GAS PIPELINE PROJECT
LOCATION	DELHI	
DESIGNED	RAHUL	PIPELINE NETWORK SCHEMATIC DIAGRAM (PH-I)
DRAWN	SUNIL	
CHECKED AND VERIFIED	ANIL KUMAR	
APPROVED	SIG (R.K.N)	SCALE : NTS (SH 1 OF 1) REV
	DATE 02/01/2010	DRG. NO. MEC/23M3/05/21/M/000/SK-01 0

ANNEXURE – VII

TYPICAL INTERFACING OF RTU WITH OTHER PANELS



NOTES:–1. IN ADDITION TO SERIAL DATA, FLOW RATE, PRESSERE & TEMPERATURE SHALL BE HARDWIRED SIGNAL FROM FLOW COMPTER TO RTU.
2. PSP VALUE, IMPRESSED VOLTAGE & IMPRESSED CURRENT SHALL BE HARDWIRED SIGNAL FROM CATHODIC PROTECTION PANEL TO RTU.
3. SEPERATE METERING PANELS SHALL BE PROVIDED BY METERING VENDOR IN WHICH FLOW COMPUTER, GC CONTROLLER SHALL BE INSTALLED.
4. HADWIRED SIGNALS FROM FIRE & GAS DETECTION PANEL, METERING PANEL, SOLAR PANEL, PDC & CATHODIC PROTECTION PANEL SHALL BE TERMINATED INSIDE TIC CABINET FROM WHERE THESE SIGNALS SHALL BE TAKEN TO RTU THROUGH HARDWIRED LINK
5. SEPERATE HARDWIRED CABLES SHALL BE USED FOR AI, AO, DI, DO SIGNALS. MIXING OF DIFFERENT TYPES OF SIGNALS SHALL NOT BE ACCEPTABLE.
6. SCOPE CF INTERFACING CABLES SHALL BE AS PER RESPECTIVE CLAUSE OF PJS

GAIL (INDIA) LIMITED

मेकॉन लिमिटेड

MECON LIMITED

SECTION LOCATION	INSTRUMETATION NEW DELHI
DESIGNED	
DRAWN	
CHECKED AND VERIFIED	
APPROVED	SIG / DATE

TYPICAL INTERFACING OF RTU WITH OTHER PANEL

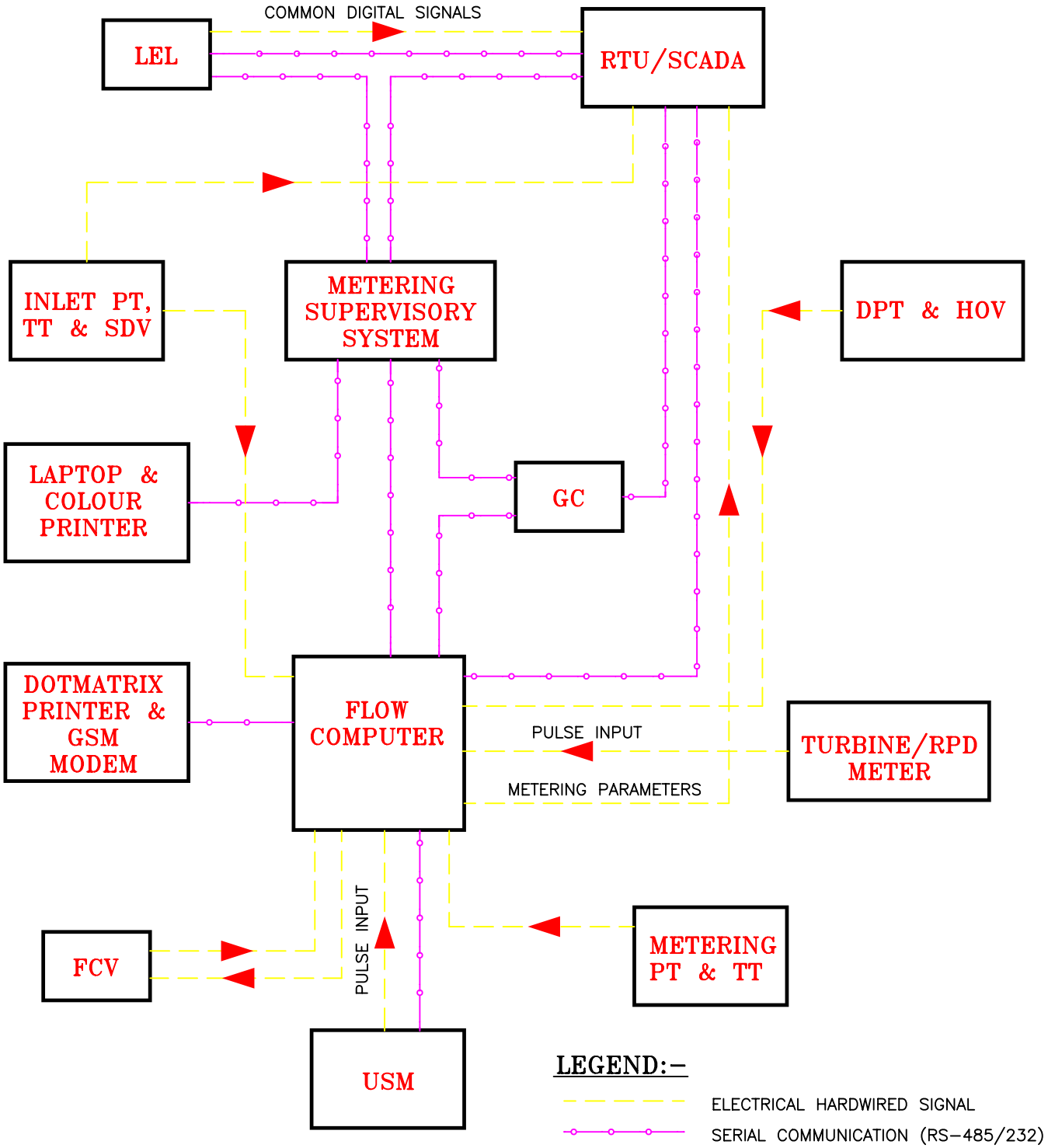
SCALE : NTS (SH. 1 OF 1) REV

DRG.NO. MEC/05/E5/094/RTU-01 1

REV / SEC CONCURRED BY

REV.NO	DATE	ZONE	GENERAL REVESION DESCRIPTION REVISION	BY	VERIFIED	REFERENCES DRG.NO.

© Copyright MECON – All right reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIED PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.



NOTE:-

1. ALL SERIAL PORT TO RTU/SCADA SHALL BE RS-485 & PROTOCOL FOR COMMUNICATION SHALL BE MODBUS.

REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.
			REVISIONS				

© Copyright MECON - All right reserved.
THIS DRAWING IS THE PROPERTY OF MECON AND ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION: INSTRUMENTATION	NAME	DATE	CHKD	DATE
DSGN	VIKAS			
DRWN	SUNIL			
APPROVED	(R. SHUKLA)			

TITLE:-

PROPOSED SYSTEM ARCHITECTURE FOR METERING SKID

मेकॉन लिमिटेड

MECON LIMITED

SCALE : NTS (SH 1 OF 1) REV 0

DRG. NO. MEC/SD/05/E5/I/SA-01

ANNEXURE – VIII

SOURCE OF SUPPLY (SOS) FORM

ANNEXURE-VIII to PJS
RTU FOR CENTRALISED SCADA SYSTEM

SOURCE OF SUPPLY FORM (SOS) FORM

Name of Bidder :
Bidder / Vendor works & address :
Name of Sub Vendor (as applicable) :

This form shall be duly filled and signed by bidder and it shall be submitted along with bid. All the points shall be unambiguously responded, if anything is kept blank by the bidder, it shall be considered as non-compliance of the tender and the bid shall be liable for rejection.

SL. No.	DESCRIPTION	MAKE	MODEL No.	Place of manufacturing and supply	Name of the Company / Organization responsible for support and maintenance facilities for this item / system
A	RTU 1. RTU a) Hardware b) Software 2. Equipment Racks 3. Any other items				
B	Mandatory Spares GSM modem with antenna & accessories				
C	GSM modem with antenna & accessories				
D	Industrial standard Tool kit for equipments with leather bag:				
E	PDT with all accessories				
F	Test equipments a) 4 ½ Digit Multi-meter b) Portable Power Source cum Calibrator (Current & Voltage) c) Protocol Analyser d) RTU configurator software				
G	Special Tools and Tackles (separate List with unit price has to be furnished with un –price offer)				
H	Any other items				

Signature of the Bidder authorized signatory

Name of the Bidder authorized signatory

Stamp and Date

ANNEXURE – IX

POWER CONSUMPTION & UTILITIES REQMT (PUCR) FORM

ANNEXURE-IX to PJS

RTU FOR CENTRALISED SCADA SYSTEM

POWER CONSUMPTION & UTILITIES REQUIREMENTS (PUCR) FORM

This form shall be duly filled ***and*** signed by bidder and it shall be submitted along with bid.

A. RTUs DC Load Requirements

S.No.	RTUs name	All RTU cards		Max. power consumption		Complete RTUs DC power requirements (watts)
		TYPE	QUANTITY	Unit consumption (watts)	Total consumption (watts)	
I		AI				
2		AO				
3		DI				
4		DO				
5		Serial				
6		CPU, communication, memory, power supply unit				
7		Any item/s not included above				

NOTE:

a) All RTU cards (including CPU, communication cards, AI, AO, DI, DO, Serial cards along with power supply unit) are included for power consumption.

b) The digital output cards power consumption (watts) shall also include the power requirements for interposing relays.

c) The above table shall be filled for all the RTUs being supplied.

ANNEXURE – X

PROJECT MANAGEMENT AND RESPONSIBILITY (PMR) FORM

ANNEXURE-X to PJS
RTU FOR CENTRALISED SCADA SYSTEM

PROJECT MANAGEMENT AND RESPONSIBILITY (PMR) FORM

Name of RTU Bidder :
RTU Vendor works & address :
Name of the sub-vendor/Service Associates :
Sub-vendor works & Address :

Activity/project Responsibility	Performed by Bidder [yes/no]	Performed by Sub-vendor / Service associate	Manufacturing facilities/ location
Single source responsibility with performance guarantee for the successful execution of the project			
Project management			
Project basic engineering activities including design			
Supply of RTU			
Development & implementation SCADA DATA			
Detailed System Engineering			
Logistic Support			
Integration of RTU and SCADA software (SCADA Supplied by other)			
Documentation 1) For RTU 2) Detailed engineering drawing and documents 3) For FAT 4) For Construction drawings & documents 5) For SAT			
Factory Acceptance Testing 1 For MS /BMS with RTUs 2 For integrated SCADA system			
Installation and commissioning of RTU at various location			
Site acceptance testing and test run			
Warranty			
Training			

Signature of the authorized signatory
Name of the authorized signatory
Stamp and Date

Note: If the activity is performed by the Bidder, and sub vendor, same shall be differentiated by letter 'P' against the party who is primarily responsible for the same activity.

ANNEXURE – XI

RESPONSIVE OFFER CRITERIA (ROC) FORM

ANNEXURE-XI to PJS
RTU FOR CENTRALISED SCADA SYSTEM

RESPONSIVE OFFER CRITERIA (ROC) FORM

			Column to be filled
A	1	Scope of supply and works complied with as per the Bid package [yes/no]	
	2	RTU specifications & configuration as per the Bid specifications [yes/no]	
B	1.	Bidder must categorically state compliance that all deviations/comments from all sections of Bid package are only listed in deviation form and all remaining clauses are deemed to be fully complied by the Bidder	
	2.	All the forms are duly filled, stamped and signed by authorized representatives at the required places [yes/no]	
	3.	Bidders proposal as per bid outline requirements [yes/no]	

Signature of the authorized signatory

Name of the authorized signatory

Stamp and Date

ANNEXURE – XII

TECHNICAL CHECKLIST FOR RTU FOR CENTRALISED SCADA SYSTEM (KKBMPL-PH-II PIPELINE)

ANNEXURE-XII to PJS
RTU FOR CENTRALISED SCADA SYSTEM

TECHNICAL CHECKLISTS

Name of Bidder :
Bidder / Vendor works & address :
Name of Sub Vendor (as applicable) :

This Technical Check list shall be dully filled in and submitted along with un-priced sets of offers to avoid further queries and to ensure proper evaluation of your offer in time. If this is not complied with your offer is liable to be rejected.

Sl. No	Checklist point	Yes / No
	Have you filled up the following formats, which form a part of technical checklist	
1.	Submit Un-priced SOR with indicated "Quoted" in price part	
2.	ANNEXURE-X Project Management & Responsibility (PMR) Form	
3.	ANNEXURE-XI Responsive Offer Criteria (ROC) Form	
4.	ANNEXURE-VIII Source Of Supply (SOS) Form	
5.	ANNEXURE – IX Power Consumption & Utilities Reqmt Form (PUCR Form)	
6.	Bill of Material (Supply) for RTU- submitted (Yes /No)	
7.	Submit Data Sheets/Technical Specifications RTU (Yes / No)	
8.	RTU Configuration Drawing Submitted (Yes/No)	
9.	Submit signed & stamped tender documents	
10.	Submit Clause wise technical compliance of PJS with Annexure	
11.	Have you filled up 'NO DEVIATION FORM' and submitted the same?	
12.	Have you provided list of spares for operation and maintenance along with unit rates?	
13.	Have you provided list of commissioning spares?	
14.	Have you enclosed the catalogs/literature in ENGLISH language including model decoding details, drawing etc necessary for evaluation of your offer?	
15.	Have you confirmed that documents required as per vendor data requirement will be supplied after placement of order?	
16.	Have you furnished System Architecture for RTU	
17.	Have you furnished 'PERFORMANCE GUARANTEE CERTIFICATE'?	
18.	Have you furnished 'Vendor Data Requirement' with all necessary documents	
19.	You quoted as OEM or System Integrator	
20.	You have 24 hr service support for O&M	
21.	Indicate deviation / discrepancy with supporting documents / reasons etc.	
22.	Letter from RTU vendor for discontinuation of product one year in advance.	
23.	Certificate for compatibility of RTU with Centralised SCADA of GAIL.	

Sl. No	Compliance to	Noted (Yes / No)
1.	Quoted for all the items	
2.	Time Schedule.	
3.	Furnished documents supporting BEC	
4.	Tender MR requirements and scope as per Job Specification	
5.	Payment Terms as per Tender	
6.	Training as per Tender	
7.	Warranty as per Tender specifications	
8.	Quoted for Extended Warranty per month (for 24 months) as per Tender specifications	
9.	Quoted for Extended Storage per month (for 12 months) payable (after 22 months) as per Tender specifications	

Signature of the Bidder authorized signatory
Name of the Bidder authorized signatory
Stamp and Date

ANNEXURE – XIII

LOGISTICS SUPPORT

ANNEXURE- XIII to PJS
RTU FOR CENTRALISED SCADA SYSTEM

CERTIFICATE FOR LOGISTICS SUPPORT

1.0 LOGISTIC SUPPORT CERTIFICATE

1.1 Vendor must furnish Certificate for providing necessary support services in favour of the Owner (M/s GAIL) for RTU committing them to provide logistic to purchaser in the format furnished along with.

1.2 In case of bought-out items, this certificate must be furnished for each of the Sub vendors clearly indicating type, model no. etc.

1.3 The Certificates must be furnished from each manufacturer in case more than one manufacturer is proposed for an item. However it is expected that the vendor proposes Only one approved manufacturer for an item.

1.4.1 The Certificate must be signed with seal by the official signatory on the company's letterhead.

CERTIFICATE FOR LOGISTICS SUPPORT

(**To be signed by Manufacturer's corporate level signatory on company's letterhead)**

I, on behalf of M/s_____ confirm that the Item _____ Model No._____ for quoted by M/s_____ for M/s GAIL against Bid Doc No. 05/51/23 ME / GAIL / 094 (RTU); respective Particular Job Specification for RTU for Centralised SCADA system No. MEC / 23 ME / 05 / E5 / I / PJS-094 (RTU) shall continue to be supported by us for a period of minimum 05 years. The quoted system shall not be withdrawn from Indian market as a matter of our corporate policy.

I further confirm that in case of placement of order by GAIL on us, we shall continue to Support GAIL by spare part support for a period of 10 years from the date of placement of order.

Signature of the Bidder authorized signatory

Name of the Bidder authorized signatory

Stamp and Date

ANNEXURE – XIV

PROCEDURE/ TEST SCHEDULE/ FORMAT FOR THE TEST OF DNP 3.0 MAPPING/ PROTOCOL/ INTEROPERABILITY DETAILS

[SCADA-RTU INTEGRATION TESTING OVER DNP3.0 PROTOCOL]

Venue of Testing :

Test Period:

RTU Vendor Details :

Address:
Contact Person:
Phone: | Fax: | Mobile:
Email: | Site: |

RTU test engineers
Engineer-
Contact Number:

[SCADA-RTU COMPATIBILITY OVER DNP3.0]

This document covers the minimum interfaces test procedure for DNP3.0 based testing over TCP/IP protocols which is as per Yokogawa India Limited Standards for their SCADA system only.

SCADA-RTU Testing Over DNP3.0

1. System Information

1.1 SCADA System

Yokogawa – FASTTOOLS SCADA System R 9.04

1.2 RTU System

1) Make :
2) Brand/Model :
3) Communication Details
   a) Protocol: DNP 3.0 : DNP3.0
   b) Connection Type: Serial/Ethernet : ETHERNET
   c) Type of Connector :
   d) IP Address Settings
      d.1) IP Address for LAN A : RTU IP for LAN A and 4 IP address for Master SCADA with 2 unique domain
      d.2) IP Address for LAN B : RTU IP for LAN B and 4 IP address for Master SCADA with 2 unique domain

      d.6) Destination Address : (DNP RTU Device Address)
      d.7) Source Address : 0 (DNP Master SCADA Address)

5) RTU Software Name and Version
6) Location of Testing :

2. DNP3.0 Test cases

2.1 Dual DNP 3.0 Station

Action: This test is to check simultaneous communication between minimum 2 SCADA Servers and a RTU over DNP3.0. Establish the necessary network connection between SCADA Servers and existing RTU and check for data transfer from RTU to each of the SCADA Server simultaneously.

Result:

Remarks:

2.2 RTU Time Stamps

Action: Compare the SCADA system clock with the equipment clock. When these are equal or nearly equal set the equipment clock for instance 5 minutes back in time. Generate a number of events with time stamp.

Result:

Remarks:

2.3 Analog Input Data for Integer and Float

Action: Add Analog Input Items and vary data using Calibrator and check the Real type values with quality flag at SCADA with DNP3.0 Object and Variations (30 and 32).

Result:

Remarks:

2.4 Digital Input Data

Action: Add Digital Input Items and check the values with quality flag at SCADA with DNP3.0 Object and Variations(01 ,02, 03 and 04).

Result:

Remarks:

2.5 Analog Output Data for Integer and Float

Action: Add Analog Output Items and check the Real values at Calibrator with Select, Execute and direct from SCADA with DNP3.0 Object and Variations (40, 41,42,43).

Result:

Remarks:

2.6 Digital Output Data

Action: Add Digital Output Items and check the values at RTU. Trip, Close, Pulse type with ON time duration, Single Bit, Select, Execute and Direct with DNP3.0 Object and Variations(10 , 11,13, object 12and variation 01).

Result:

Remarks:

2.7 MODBUS Data with Third party system through Serial Interface

Action: Add Items at RTU and check the data (Holding Register, Input Register, Coil Register and Input Status Register) from Third Party System/Modbus Simulator. This data should transfer over DNP3.0 protocol with quality flag for SCADA system.

Result:

Remarks:

2.8 Network Redundancy Check

Action: Check Data transfer over DNP3.0 using Redundant Communication Ports by disconnecting one port at a time and successful data transfer over other port.

Result:

Remarks:

2.9 Time Synchronization Check

Action: Check Time Synchronization over DNP3.0 using Communication Ports by changing RTU time and successful update of RTU time as per SCADA Server time.

Result:

Remarks:

2.10 Communication Statistics

Action : RTU should support Object 80 for internal indication as per DNP3.0 protocol for making healthiness of RTU at Master SCADA level.

Result:

Remarks:

2.11 Report by exception for AI and DI based on Class 1, Class 2 and Class 3 request

Action : RTU should be able to exchange the data with SCADA for Event changes in the RTU.

Result:

Remarks:

2.12 On demand Scan from SCADA for AI and DI based on Class 0, Class 1, Class 2 and Class 3 request.

Action : RTU should be able to exchange the Complete data with SCADA for On Demand poll (Class 0, Class 1, Class 2 and Class 3). The Application fragment should not exceed 4 Kbyte. The data link frame size should not exceed 292 bytes.

Result:

Remarks:

2.13 Minimum Object and Variation supports from RTU

Action : DNP 3 Objects : 30,32,01,02,03,04,40,41,42,43,10,11,13,80 and (object 12 & variation 01).

Result:

Remarks:

ANNEXURE – XV

MODBUS RTU DATA FORMAT DETAILS TO BE PROVIDED BY RTU VENDOR

Customer:GAIL
End User: GAIL

Sub System Mapping List

Yokogawa India Ltd

Modbus Device																			
S.No	Field Tag No	RTU Tag No	Service	Signal Type	Station ID	Data Type	Read / Write	Register Address	Function Code	Swapping or not	Range LO	Range HI	Engg Unit	Set Point	Alarm LO	Alarm LOLO	Alarm HI	Alarm HIHI	Alarm Priority	REMARKS

ANNEXURE – XVI

DEVIATION FORM

ANNEXURE-XVI to PJS
RTU FOR CENTRALISED SCADA SYSTEM

DEVIATION FORM

Name of Bidder :

Schedule of Deviation :

Bidder shall; note that this is a **"NO DEVIATION TENDER"**

1. Bidder may given here a consolidated list of deviations/ clarifications/ comments of all sections of the bid package, which for an appropriate offer are considered unavoidable by him.

2. Deviations/ clarifications mentioned elsewhere in the offer shall not be bidding on the Client / Consultant and any such deviations if indicated elsewhere other than this form will render the offer non-responsive and shall liable to be rejected.

3. Bidder shall state the reasons for the deviations in the 'Remark' column.

4. All other clauses of the bid package shall be deemed to be fully complied by the Bidder.

5. **Only the deviations listed herein, in conjunction with the Bid package, shall constitute the contract requirements for the award of job to the Bidder.**

S.No.	Page No.	Clause No.	Requirement	Deviations as per Bid package	Clarification/ Comments by Bidder	Remarks
1						
2						
3						
4						
5						
6						
7						

Signature of the Bidder authorized signatory

Name of the Bidder authorized signatory

Stamp and Date